

# Guide to statistics in European Commission development cooperation

VOLUME 4: ENVIRONMENT AND CLIMATE CHANGE

2021 edition



This document should not be considered as representative of the European Commission's official position.

Luxembourg: Publications Office of the European Union, 2021

© European Union, 2021



The reuse policy of European Commission documents is implemented based on Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39).

Except otherwise noted, the reuse of this document is authorised under a Creative Commons Attribution 4.0 International (CC-BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated.

Copyright for illustrations: © European Commission

Cover image: Hans Braxmeier@pixabay.com; V4.1 cover: Albrecht Fietz@pixabay.com; V4.2 cover: Kervin Edward Larapixabay.com; V4.3 cover: Eveline de Bruin@pixabay.com.

For any use or reproduction of elements that are not owned by the European Union, permission may need to be sought directly from the respective rightholders.

For more information, please consult: <https://ec.europa.eu/eurostat/about/policies/copyright>

## Foreword

Reliable and relevant statistics are essential for all aspects of public discourse and for holding governments accountable. They constitute a key tool for governments and policy makers to measure progress towards development goals and provide information about the effectiveness of policies and programmes.

This Guide provides extensive information on statistics in development cooperation, presenting key international initiatives supporting developing countries in building sustainable statistical systems that produce quality statistics. It provides information on how to identify and develop actions in support of key statistics and how to use data and indicators to define and follow-up cooperation programmes.

This edition also includes various key developments, including the sustainable development goals (SDGs) and the SDG indicators framework, the UN World Data Forum and other related initiatives. The implementation of development programmes aimed at achieving the SDGs has further raised the demand for high-quality statistics in this area.

The EU is the biggest provider of development assistance in the world. In the area of statistics, the European Commission, together with the EU Member States, is highly involved in the field of international statistical cooperation, with Eurostat — the Statistical Office of the EU — at the forefront of developing methodology and instruments for harmonised and reliable statistics. This publication is intended to support EU Delegations around the world, as well as various EU/EC services, and more generally, those involved in implementation of statistical cooperation programmes.

For a non-statistician, the Guide explains how national statistical systems are organised and how they function, the central role of national statistical offices, as well as core international quality frameworks and principles for statistics. Overall, the Guide has been designed as a dynamic, interactive tool providing technical references and guidance on statistics, through hundreds of active hyperlinks for further information.

This updated version of the Guide is the fifth consecutive edition; the first edition was published a decade ago. To make the Guide easier to use, it has been divided into a core volume, supplemented by chapters that present statistics and statistical processes in specific sectors (gathered into a set of four thematic volumes): Sustainable Development Goals and indicators; social statistics; economic statistics and; environment and climate change statistics. With the exception of the volume on economic statistics, the whole publication has been updated for this edition.

Since the start of 2020, the world has been under immense strain from the COVID-19 pandemic and its repercussions. The setback caused by the pandemic and its dire consequences for finances and capacity in many societies may further amplify the challenges. The need for support through capacity development and technical assistance is therefore more vital than ever. In this context, the demand for data and statistics to monitor and evaluate this dynamic situation has become proportionally greater, with a requirement for new statistics and more rapid results.

I hope you will find this new edition of the Guide useful. As always, Eurostat welcomes any feedback and ideas on how to develop it further.



**Mariana Kotzeva**

Director-General, Eurostat

## Acknowledgements

Eurostat is grateful to those who provided their contributions towards the compilation of this Guide.

The main author has been Knut E. Utvik, Artemis Information Management S.A., with additional contributions by Thierry Paccoud.

The chapters on specific statistical domains covered in the Guide's new thematic volumes have been written and/or updated by Artemis' contributors Bahjat Achikbache, Virginia Balea, Giambattista Cantisani, Loïc Coënt, Willibald Croi, Marie Noelle Dietsch, Mathieu B. Djayeola, Neil Dourmashkin, Gaetano Ferrieri, Gaston L. N. Gohou, Nathalie Grand, Paddy Hillyard, Deborah Horn, Michel Houssiau, Antonia Huttl, Stephane Quefelec, Deo Ramprakash, Liv Hobbelstad Simpson, Volker Stabernak and Mohamadou Sy.

The layout and the interactive content of the Guide have been prepared by Mario Colantonio and Christiane Gengler, Artemis Information Management S.A.

Eurostat's editorial work has been done by Veronika Radermacher, Fernando Cortina Garcia, Otilia Trandafir and Francisco de Miguel from Unit B3 "Enlargement, neighbourhood and development cooperation", with Avis Beneš as Head of Unit. Unit B3 would like to thank all the contributors to this Guide, specially Eurostat Units E.2, E.5, F.2, F.3, F.4, F.5 and 01 for their support.

All statements on policies within this publication are given for information purpose only. They do not constitute an official policy position of European Commission and are not legally binding.

## Contact details

Eurostat — Unit B3: Enlargement, neighbourhood and development cooperation

5, rue Alphonse Weicker

2721 Luxembourg

LUXEMBOURG

E-mail: [estat-statistical-cooperation@ec.europa.eu](mailto:estat-statistical-cooperation@ec.europa.eu)

# Contents

|  |           |
|--|-----------|
| <b>Foreword .....</b>  | <b>3</b>  |
| <b>Acknowledgements .....</b>  | <b>4</b>  |
| Contact details .....  | 4         |
| <b>Introduction: The guide to the Guide .....</b>  | <b>7</b>  |
| Why a Guide to statistics in European Commission development cooperation and who should read it? .....     | 7         |
| <b>V4.1. Environment statistics .....</b>  | <b>10</b> |
| V4.1.1. Policy applications: what this data is used for .....  | 10        |
| V4.1.1.1 Environment indicators and policies .....   | 10        |
| V4.1.1.2 Environment SDG indicators .....  | 11        |
| V4.1.2. Air – statistics on emissions to air and ozone depleting substances .....                          | 14        |
| V4.1.2.1. Concepts and definitions .....   | 14        |
| V4.1.2.2. Sources of data .....  | 16        |
| V4.1.3. Air quality indicators .....   | 17        |
| V4.1.3.1. Concepts and definitions .....   | 17        |
| V4.1.3.2. Sources of data .....  | 18        |
| V4.1.4. Water – statistics on emissions to water and water resources .....                                 | 19        |
| V4.1.4.1. Concepts and definitions .....   | 19        |
| V4.1.4.2. Sources of data .....  | 19        |
| V4.1.5. Water quality indicators .....   | 21        |
| V4.1.5.1. Concepts and definitions .....   | 21        |
| V4.1.5.2. Sources of data .....  | 23        |
| V4.1.6. Waste – statistics on waste generation, movements of hazardous wastes, recycling and disposal .... | 24        |
| V4.1.6.1. Concepts and definitions .....   | 24        |
| V4.1.6.2. Sources of data .....  | 25        |
| V4.1.7. Biodiversity and protected areas .....   | 26        |
| V4.1.7.1. Concepts and definitions .....   | 26        |
| V4.1.7.2. Sources of data .....  | 27        |
| V4.1.8. Land cover and land use statistics .....   | 28        |
| V4.1.8.1. Concepts and definitions .....   | 28        |
| V4.1.8.2. Sources of data .....  | 28        |
| V4.1.9. Analysing data quality and identifying problems .....  | 30        |
| V4.1.10. Improving sector statistics .....   | 32        |
| <b>V4.2. Energy statistics .....</b>   | <b>39</b> |
| V4.2.1. Policy applications: what energy data is used for .....  | 39        |
| V4.2.2. Concepts and definitions in energy statistics .....  | 40        |
| V4.2.3. Sources of energy data and metadata .....  | 42        |
| V4.2.4. Analysing quality of energy data and identifying problems .....                                    | 47        |

|  |           |
|--|-----------|
| V4.2.5. Key issues for building or improving a statistical system in the energy sector ..... | 47        |
| <b>V4.3. Agricultural, forestry and fishing statistics.....</b>                              | <b>53</b> |
| V4.3.1. Policy applications: what this data is used for .....                                | 53        |
| V4.3.2. Concepts and definitions .....   | 53        |
| V4.3.2.1 Agricultural production statistics - crop and animal production .....               | 54        |
| V4.3.2.2 Agricultural censuses and surveys on the structure of agricultural holdings.....    | 54        |
| V4.3.2.3. Agricultural price statistics .....  | 56        |
| V4.3.2.4 Food balance sheets .....   | 56        |
| V4.3.2.5 Economic accounts for agriculture .....   | 57        |
| V4.3.2.6 Agri-environmental indicators .....   | 58        |
| V4.3.2.7 Forestry statistics.....  | 59        |
| V4.3.2.8 Fisheries statistics.....   | 59        |
| V4.3.2.9 Agriculture SDG indicators.....   | 60        |
| V4.3.3. Sources of data and metadata .....   | 62        |
| V4.3.4. Analysing data quality and identifying problems.....                                 | 62        |
| V4.3.5. Improving sector statistics.....   | 63        |

# Introduction: The guide to the Guide

## Why a Guide to statistics in European Commission development cooperation and who should read it?

**'I have no data yet. It is a capital mistake to theorise before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts..'**

**Sherlock Holmes in 'A Scandal in Bohemia' by Sir Arthur Conan Doyle, 1891**

The purpose of the Guide to statistics in European Commission development cooperation is to explain why statistics are important for development cooperation, how to use them and what needs to be done to make them available. It is not intended to be a course in statistics and statistical methods. Alternative and additional reading is shown in the 'To find out more' box at the end of each section.

The Guide is the fruit of a close cooperation amongst Commission services and international stakeholders in statistical co-operation for development. It is principally aimed at supporting EU staff working in development cooperation, especially in EU delegations. However, it is also relevant to other actors in statistical development programmes. In particular, it aims to aid practitioners who need to know more about statistics in development cooperation context. The Guide explains why and how statistics are relevant to their work and what they need to do in various situations. It provides the information required for Commission staff to undertake the following tasks:

- Use statistical indicators to design and monitor development programmes;
- Identify and develop statistics support actions;
- Promote the use of statistics at each stage of the aid cycle;
- Advocate for early consideration of which statistics and indicators will be needed for implementation, evaluation and impact assessment (and what is required to obtain these).

The Guide aims to answer a number of basic questions about development statistics:

- Part A, this Introduction, is a guide to when and how to consult the Guide
- Part B: Statistics in Development looks at why and how statistics enter the development process and how to understand and check data
- Part C: Support for Statistics considers when and how the European Community needs to act to make sure that good quality statistics are available to support its development goals
- Parts A-C are completed by four thematic volumes dealing with the use of Statistics for Policy Issues. Chapters in these volumes look at how statistics can be used and supported to achieve European Commission policy aims in specific sectors.

When arguing that statistics are important but bread is more urgent, one should ask oneself on what information the answers to the following questions are based: 'How much bread?' and 'Where is it needed?' Development fundamentally is about people and about eliminating poverty. In order to manage the process, it is essential to measure it. While statistics may not directly reduce poverty or hunger, they are an essential component of a complex process; without adequate statistical data it is by no means certain that actions to reduce poverty will be directed at the right problem, that they will be effective or that they will result in sustained improvements.

It is obvious that good and reliable statistics are necessary to donors, in order to assess where aid is most needed, to use resources efficiently, to measure progress and to evaluate results. There is broad consensus that the Sustainable Development Goals (SDGs) identify the desired outcomes as well as the means for measuring progress. Thus, statistics are vital to 'Managing for Development Results' with shared accountability and focus on results.

A key issue is the need for good country-specific and country-owned policies and institutions. Better statistical data and improved analysis can create a political will for changes. Without good statistics, governments cannot deliver efficient administration, good management, and evidence-based policymaking. An effective and efficient national statistical system, providing regular and reliable data on the economy and the well-being of the population, is an important indicator of good policies and a crucial component of good governance.

Statistics also provide a means for the media, non-governmental organisations and any citizen to monitor the activities of government. The ability to provide regular and reliable data on the economy and the well-being of the population is an important indicator of good policies and institutions. When the statistical system produces quality data which is trusted by the public, transparency increases and accountability is promoted. The quality and availability of data depend on the capacity of the institutions involved in the national statistical system, which are often undervalued and underfunded.

This Guide, and in particular this volume, will help you find what you want to know about statistics for environment and climate change

***How to read this volume of the Guide***

There are text boxes at the start and end of each chapter. The chapter in brief box starts each chapter and provides a summary of one to two paragraphs. Most sections and each sector chapter end with a 'To find out more' box, which provides references, hyperlinks and supporting information for further research.

The table of contents is provided in detail so that most key issues can be found easily. Hyperlinks are also provided to Eurostat's Concepts and Definitions Database (CODED) and OECD's Glossary of Statistical Terms, as well as to the International Statistical Institute's (ISI) Multilingual Glossary of Statistical Terms.

The Guide is prepared primarily to be used as an electronic document to be disseminated in PDF format. To navigate through the text and find related information, the user can simply click on the interactive links from the Table of Contents. To consult external references over the Internet, the user just has to click on the hyperlinks in the 'To find out more' boxes. The user may also use the normal 'search' facility for PDF documents to find the information of interest, searching on specific keywords or key terms.

***To find out more...***

These boxes, provided at the end of most sections, summarise reference documents and in most cases give hyperlinks to them, e.g.:

- [Eurostat's Concepts and Definitions Database \(CODED\)](#)
- [OECD's Glossary of Statistical Terms](#)
- [International Statistical Institute's \(ISI\) Multilingual Glossary of Statistical Terms](#)
- [European Consensus on Development](#)
- [Conference of European Statisticians: Classification of Statistical Activities \(CSA\)](#)

# V4.1

## Environment statistics



## V4.1. Environment statistics

### The chapter in brief

This chapter covers statistics and indicators relevant to European Commission development cooperation in the field of the environment and sustainable management of natural resources.

The present chapter on environmental indicators starts by listing the main contributions of environmental indicators to environmental and economic policies. It continues by identifying several key indicators used for the environmental issues or topics:

- Air – statistics on emissions to air and ozone depleting substances
- Air quality indicators
- Water – statistics on emissions to water and water resources
- Water quality indicators
- Waste statistics
- Statistics on biodiversity – protected areas
- Land use and land cover statistics

For each indicator mentioned, a brief definition is provided; the environmental issues and relevance for environmental policy are highlighted; the main international agreements and targets are also indicated.

Environment statistics are continuously developed and improved according to new needs, findings and new requirements. This is reflected in the current chapter. To be informed of the most recent developments in this statistics domain, it is recommended to follow the references given in the 'To find out more' boxes provided throughout the chapter.

Environmental indicators contribute to:

- Identifying key factors that cause pressure on the environment;
- Measuring environmental performance with respect to environmental quality and environmental goals; they help set priorities and quantitative targets;
- Assessing compliance with national legislation, international agreements and other commitments;
- Integrating environmental concerns in economic and sectoral policies; they help update policies in environmentally significant economic sectors;
- Monitoring progress towards environmentally sustainable development, including decoupling of environmental pressure from economic growth;
- Measuring material flows and resource productivity;
- Informing the public about major environmental trends and conditions: providing information on driving forces, impacts and policy responses is also a common strategy to strengthen public support for policy measures.

Like other indicators they have to be interpreted in context and be complemented with country specific information to acquire their full meaning.

Air and water quality indicators calculated and obtained from monitoring data describe the state of these two media (see Box V4.1.1). They are key indicators as they allow evaluation of the importance of the pressures exerted on air and water (pressure indicators), as well as evaluation of impacts on the environment and human health (impact indicators). This will in turn allow development and implementation of remedial actions (response indicators); the DPSIR approach is detailed in Box V4.1.2).

In addition, environmental indicators are intended to help:

- Improve environmental reporting at both national and international levels;
- Make their national environmental assessments comparable with other countries;
- Facilitate data gathering for future regional / national environmental reports.

Several international organisations have activities to develop frameworks and indicator sets for environmental issues, environment-sector integration and sustainable development issues. A list of these can be found in the 'To find out more' box at the end of this section.

Criteria used in selecting environmental indicators are:

- Relevance to national environmental priorities;
- Relation to international environmental policy;
- Role as a means of communication for public awareness;
- Measurability;
- Availability of time series;
- Predictive ability: capacity to track the effectiveness of pursued environmental policy.

### V4.1.1. Policy applications: what this data is used for

#### V4.1.1.1 ENVIRONMENT INDICATORS AND POLICIES

Environmental indicators should be statistics that are scientifically credible and representative of an environment issue. They should be key, powerful and cost-effective tools for environment assessment. Appropriately chosen indicators based on sufficient time series data can show important trends and help describe causes and effects of environmental conditions. They make it possible to track implementation of environmental policies and to assess their efficiency. Environmental indicators can be measured and reported at different scales and at different levels.

National governments use environmental indicators to show the current status and trends with respect to environmental issues of importance, to develop or adapt their environmental policies and to inform their citizens. For example, a town may monitor air quality to estimate health impact on the population, degradation of buildings, etc., or track air quality along with water quality or count the number of rare species to estimate the health of the environment in their area.

**Box V4.1.1: Monitoring as a part of environmental management**

Environmental monitoring can be described as repeated measurements, with certain intervals, of relevant characteristics with comparable (standardised) methods, in order to follow changes and trends in nature and the environment due to anthropogenic (human-generated) activities over a period of time.

The overall objective of monitoring is not to produce data, but to create relevant information. Therefore, it is essential to identify information needs and the users, as well as to quantify the use of environment information for environmental management. Different information needs may require different monitoring objectives, e.g. to assess average state, in order to adjust management, to check compliance with standards or limit values and/or to detect and assess impacts (e.g. from point sources of pollution). etc. Regarding the decision makers, the information would in principle be used to detect problem areas where changes in environmental management are needed and to identify and prioritise efforts to be undertaken.

The responsible public bodies, such as the Ministry of the Environment or an environmental agency, prepare tailor-made strategies for the implementation of monitoring activities between different authorities, institutes and other stakeholders. Such strategies are based on information needs and encompass responsibilities and business rules between participating institutes, as well as setting monitoring priorities. Such strategies have to be revised on a regular basis (e.g. every 5–10 years).

Keeping in mind that practical solutions should always be preferred, the basic rules for a successful environmental monitoring and assessment programme, as well as for the establishment of a useful monitoring network can be condensed to some key considerations:

- Information needs must be defined prior to the elaboration of the monitoring programme itself.
- Adequate financial support must be secured.
- Step-by-step approach can be used in implementing the programme.
- Technical details (e.g. pollutants to be monitored, sampling frequency, measurement methods, etc.) must be clearly defined in the programme.
- The programme must be evaluated periodically.
- Background data and other monitoring data (like meteorological and statistical data) are nearly always necessary, especially in the assessment and reporting phases.

**Box V4.1.2: The DPSIR framework**

At present, most indicator reports compile sets of physical, biological or chemical indicators. They generally reflect a system analysis view of the relations between the environmental system and the human system.

According to this system analysis view, social and economic developments are (i) **Driving forces** that exert (ii) **Pressure** on the environment and, as a consequence, the (iii) **State** of the environment changes, such as the provision of adequate conditions for health, resource availability and biodiversity. Finally, this leads to (iv) **Impacts** on human health, ecosystems and materials that may elicit a societal (v) **Response** that feeds back on the (i) Driving forces or on the state or impacts directly, through adaptation or curative action. This causal chain is the so-called “DPSIR approach”.

From the policy point of view, there is a need for clear and specific information on these five elements. This is achieved by using environmental indicators reflecting the links between human activities and their ultimate environmental impacts as well as the societal responses to these impacts.

Most sets of indicators presently used by national and international bodies are based on the DPSIR-framework or a subset of it.

Source: [Environmental indicators: Typology and overview, EEA Technical Report No 25/1999](#)

- |        |  |
|--------|--|
| SDG 6  | Ensure availability and sustainable management of water and sanitation for all   |
| SDG 11 | Make cities and human settlements inclusive, safe, resilient and sustainable   |
| SDG 12 | Ensure sustainable consumption and production patterns   |
| SDG 13 | Take urgent action to combat climate change and its impacts  |
| SDG 14 | Conserve and sustainably use the oceans, seas and marine resources for sustainable development   |
| SDG 15 | Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss |

The Global indicator framework for the Sustainable Development Goals and targets cover a 231 unique indicators for monitoring of progress towards the SDGs and their targets (12 of these indicators inform two or three different targets). Some indicators on related issues are covered under other SDGs, such as SDG 3 ‘Ensure healthy lives and promote well-being for all at all ages’ (indicators 3.9.1 ‘Mortality rate attributed to ambient air pollution’, 3.9.2 ‘Mortality rate attributed to unsafe water and sanitation’, and 3.9.3 ‘Mortality rate attributed to unintentional poisoning’) as well as SDG 9 ‘Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation’ (indicator 9.4.1 ‘CO<sub>2</sub> emission per unit of value added’).

The following table shows where the material related to each of these SDG environment indicators is covered.

**V4.1.1.2 ENVIRONMENT SDG INDICATORS**

Environmental sustainability is one of the key pillars of sustainable development. Environmental sustainability is at the core of several of the Sustainable Development Goals, and are closely related to the environment statistics covered by this chapter:

**Box V4.1.3: Selected SDG indicators on environmental sustainability**

| SDGs and indicators   |   | Relevant to sub-chapter |   |
|---|---|-------------------------|---|
| SDG 3 Ensure healthy lives and promote well-being for all at all ages   |   |                         |   |
| 3.9.1   | Mortality rate attributed to household and ambient air pollution  | V4.1.3                  | Air quality indicators  |
| 3.9.2   | Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services)   | V4.1.5                  | Water quality indicators  |
| 3.9.3   | Mortality rate attributed to unintentional poisoning  | V4.1.3                  | Air quality indicators;   |
|   |   | V4.1.5                  | Water quality indicators  |
| SDG 6 Ensure availability and sustainable management of water and sanitation for all                            |   |                         |   |
| 6.1.1   | Proportion of population using safely managed drinking water services   | V4.1.5                  | Water quality indicators  |
| 6.3.1   | Proportion of domestic and industrial wastewater flows safely treated   | V4.1.4                  | Water – statistics on emissions to water and water resources;                                 |
|   |   | V4.1.5                  | Water quality indicators  |
| 6.3.2   | Proportion of bodies of water with good ambient water quality   | V4.1.5                  | Water quality indicators  |
| 6.4.1   | Change in water-use efficiency over time  | V4.1.4                  | Water – statistics on emissions to water and water resources                                  |
| 6.4.2   | Level of water stress: freshwater withdrawal as a proportion of available freshwater resources  | V4.1.4                  | Water – statistics on emissions to water and water resources                                  |
| 6.5.1   | Degree of integrated water resources management   | V4.1.4                  | Water – statistics on emissions to water and water resources                                  |
| 6.5.2   | Proportion of transboundary basin area with an operational arrangement for water cooperation  | V4.1.4                  | Water – statistics on emissions to water and water resources                                  |
| 6.6.1   | Change in the extent of water-related ecosystems over time  | V4.1.4                  | Water – statistics on emissions to water and water resources                                  |
| SDG 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation |   |                         |   |
| 9.4.1   | CO <sub>2</sub> emission per unit of value added  | V4.1.2                  | Air – statistics on emissions to air and ozone depleting substances                           |
| SDG 11 Make cities and human settlements inclusive, safe, resilient and sustainable                             |   |                         |   |
| 11.3.1  | Ratio of land consumption rate to population growth rate  | V4.1.8                  | Land cover and land use statistics  |
| 11.6.1  | Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities  | V4.1.6                  | Waste – statistics on waste generation, movements of hazardous wastes, recycling and disposal |
| 11.6.2  | Annual mean levels of fine particulate matter (e.g. PM <sub>2.5</sub> and PM <sub>10</sub> ) in cities (population weighted)  | V4.1.3                  | Air quality indicators  |
| 11.7.1  | Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities   | V4.1.8                  | Land cover and land use statistics  |
| SDG 12 Ensure sustainable consumption and production patterns   |   |                         |   |
| 12.4.1  | Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement | V4.1.6                  | Waste – statistics on waste generation, movements of hazardous wastes, recycling and disposal |
| 12.4.2  | (a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment   | V4.1.6                  | Waste – statistics on waste generation, movements of hazardous wastes, recycling and disposal |
| 12.5.1  | National recycling rate, tons of material recycled  | V4.1.6                  | Waste – statistics on waste generation, movements of hazardous wastes, recycling and disposal |
| SDG 13 Take urgent action to combat climate change and its impacts  |   |                         |   |
| 13.2.1  | Number of countries with nationally determined contributions, long-term strategies, national adaptation plans, strategies as reported in adaptation communications and national communications                                  | V4.1.2                  | Air – statistics on emissions to air and ozone depleting substances                           |

**Box V4.1.3: Selected SDG indicators on environmental sustainability**

|  |   |        |   |
|--|---|--------|---|
| 13.2.2   | Total greenhouse gas emissions per year   | V4.1.2 | Air – statistics on emissions to air and ozone depleting substances |
| 13.b.1   | Number of least developed countries and small island developing States with nationally determined contributions, long-term strategies, national adaptation plans, strategies as reported in adaptation communications and national communications   | V4.1.2 | Air – statistics on emissions to air and ozone depleting substances |
| <b>SDG 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development</b>   |   |        |   |
| 14.1.1   | (a) Index of coastal eutrophication; and (b) plastic debris density   | V4.1.5 | Water quality indicators  |
| 14.2.1   | Number of countries using ecosystem-based approaches to managing marine areas   | V4.1.4 | Water – statistics on emissions to water and water resources        |
| 14.3.1   | Average marine acidity (pH) measured at agreed suite of representative sampling stations  | V4.1.5 | Water quality indicators  |
| 14.4.1   | Proportion of fish stocks within biologically sustainable levels  | V4.1.7 | Biodiversity and protected areas                                    |
| 14.5.1   | Coverage of protected areas in relation to marine areas   | V4.1.7 | Biodiversity and protected areas                                    |
| 14.6.1   | Degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing  | V4.1.7 | Biodiversity and protected areas                                    |
| 14.7.1   | Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries   | V4.1.7 | Biodiversity and protected areas                                    |
| 14.c.1   | Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nations Convention on the Law of the Sea, for the conservation and sustainable use of the oceans and their resources  | V4.1.7 | Biodiversity and protected areas                                    |
| <b>SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</b> |   |        |   |
| 15.1.1   | Forest area as a proportion of total land area  | V4.1.8 | Land cover and land use statistics                                  |
| 15.1.2   | Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type  | V4.1.7 | Biodiversity and protected areas                                    |
| 15.2.1   | Progress towards sustainable forest management  | V4.1.8 | Land cover and land use statistics                                  |
| 15.3.1   | Proportion of land that is degraded over total land area  | V4.1.8 | Land cover and land use statistics                                  |
| 15.4.1   | Coverage by protected areas of important sites for mountain biodiversity  | V4.1.7 | Biodiversity and protected areas                                    |
| 15.4.2   | Mountain Green Cover Index  | V4.1.7 | Biodiversity and protected areas                                    |
| 15.5.1   | Red List Index  | V4.1.7 | Biodiversity and protected areas                                    |
| 15.7.1   | Proportion of traded wildlife that was poached or illicitly trafficked  | V4.1.7 | Biodiversity and protected areas                                    |
| 15.8.1   | Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species  | V4.1.7 | Biodiversity and protected areas                                    |
| 15.9.1   | (a) Number of countries that have established national targets in accordance with or similar to Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020 in their national biodiversity strategy and action plans and the progress reported towards these targets; and (b) integration of biodiversity into national accounting and reporting systems, defined as implementation of the System of Environmental-Economic Accounting | V4.1.7 | Biodiversity and protected areas                                    |

**Box V4.1.3: Selected SDG indicators on environmental sustainability**

|        |  |        |                                  |
|--------|--|--------|----------------------------------|
| 15.a.1 | (a) Official development assistance on conservation and sustainable use of biodiversity; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments | V4.1.7 | Biodiversity and protected areas |
| 15.b.1 | (a) Official development assistance on conservation and sustainable use of biodiversity; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments | V4.1.7 | Biodiversity and protected areas |
| 15.c.1 | Proportion of traded wildlife that was poached or illicitly trafficked   | V4.1.7 | Biodiversity and protected areas |

## V4.1.2. Air – statistics on emissions to air and ozone depleting substances

### V4.1.2.1. CONCEPTS AND DEFINITIONS

Key environmental indicators in this environmental sector are (UNECE classification):

- A. Emissions of pollutants into the atmospheric air
- B. Ambient air quality in urban areas
- C. Consumption of ozone-depleting substances

Indicators related to air emissions concern pollutants causing harm to human health and/or to ecosystems. They also cover substances contributing to the greenhouse effect and to climate change. The main substances covered are: sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), ammonia (NH<sub>3</sub>), particulate matter (PM), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), non-methane volatile organic compounds (NMVOCs), persistent organic pollutants (POPs, including polychlorinated biphenyls (PCBs), dioxins/furans and polycyclic aromatic hydrocarbons (PAHs)) and heavy metals (cadmium, lead and mercury) emitted into the ambient air.

An emission inventory is an account of the amount of pollutants set free into the atmosphere. It usually contains the total emissions for one or more air pollutants, stemming from all types of emission sources in a certain geographical area and within a specified time span, usually a certain year. The statistics used are the total emission volumes and the volumes broken down by economic activities. In this context, the economic activities are defined by the International Standard Industrial Classification of All Economic Activities (ISIC) or by the Selected Nomenclature for Sources of Air Pollution (SNAP). SNAP considers 11 relevant sectors: (1) combustion in the energy production and transformation industry, (2) non-industrial combustion plants, (3) combustion in the manufacturing industry, (4) industrial processes without combustion, (5) extraction and distribution of fossil fuels and geothermal energy, (6) solvent and other product use, (7) road transport, (8) other mobile sources and machinery, (9) waste treatment and disposal, (10) agriculture and (11) other sources and sinks.

The emission values are generally expressed in thousands of tonnes (Kt) or million grams (Mg) per year, as appropriate for a particular pollutant. For cross-country comparisons, emissions

may also be presented per km<sup>2</sup> of the country's territory, per capita or per unit of gross domestic product (GDP). These emission inventories give a measure of existing and expected pressure on the environment in terms of emissions of harmful substances into the atmospheric air and "distance to target" (if any).

The main source for many pollutants is the burning of fuels, above all petroleum products. In some countries, agriculture and burning of savannas are also important contributors. However, it is difficult to estimate these emissions and data are often not available.

The key question to be answered is what progress is being made in reducing emissions of pollutants across the country/region? The indicators on emissions to air are important for following manmade emissions that substantially increase the atmospheric concentrations of greenhouse gases. They are also vital for assessing the pressure on atmospheric air quality in the country as a whole. These indicators also allow identifying pressure from sectors such as energy, transport, industrial processes, agriculture and waste management.

Indicators on greenhouse gases emissions was part of the monitoring framework for the Kyoto Protocol, which was a protocol under the United Nations Framework Convention on Climate Change (UNFCCC). The Kyoto Protocol was aimed at fighting global warming and achieving the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".

The Kyoto Protocol has been superseded by the Paris Agreement on climate change mitigation, adaptation and finance. The Paris Agreement is a separate instrument under the UNFCCC rather than an amendment of the Kyoto Protocol. Its goal is to limit global warming to well below 2 degrees Celsius, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by 2050. Under the Paris Agreement, each country must determine, plan and regularly report on its contribution to mitigate global warming.

Information on pollutant emissions is also needed for the assessment of trans-boundary air pollution and for international cooperation to address this problem. This aspect is addressed in the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP). It requires

**Box V4.1.4: Transparency framework under the Paris Agreement**

The Nationally Determined Contributions (NDCs) were the main outcome of the Paris Agreement. NDCs represent the countries' ambition to reduce national emissions and adapt to the impacts of climate change. Together, these climate actions determine whether the world achieves to reach global peaking of greenhouse gas (GHG) emissions as soon as possible and to undertake rapid reductions thereafter in accordance with best available science.

Under the Enhanced Transparency Framework within the Paris agreement, developing countries will be required to prepare a Biennial Transparency Reports (BTR), which entails a large amount of quantitative information related to the emissions mitigation and adaptation contributions. Some key elements for the BTR were presented by the German International Cooperation Agency (GIZ) in a publication and are summarized here below.

Developing countries will have to submit National Inventory Report (NIR) on anthropogenic emissions by sources and removals by sinks of GHGs (submitted as a stand-alone report or as a component of a BTR). This NIR must:

- Follow the 2006 IPCC guidelines (and any subsequent refinements)
- Include CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub>, and it can include HFCs, PFCs, SF<sub>6</sub> and NF<sub>3</sub>
- Use the Global Warming Potentials (GWP) of the IPCC Fifth Assessment Report
- Include mandatory key category analysis,
- Use higher tier methods to the key categories (flexibility for developing countries),
- Include consistent time series that should go back, at least, to the base year of the NDC and should encompass all years starting from 2020
- Present the latest reporting year which shall be no more than three years prior to the submission of NIR (x-3)
- Include an uncertainty analysis,
- Include Quality Assurance / Quality Control (QA/QC) plans.
- Countries shall provide the necessary information to track progress made in implementing and achieving NDCs (also mandatory for developing countries). This includes:
  - The national circumstances and institutional arrangements relevant to progress made in implementing and achieving
  - The information on target and description, target year or period, reference point (base year), scope and coverage, use of cooperative approaches (market mechanisms).
  - The information on relevant indicators needed to track progress in their implementation. The indicators can be quantitative or qualitative and indicator data has to be provided for all reporting years.

Parties shall present in narrative and tabular format information on actions, policies and measures that support the implementation and achievement of its NDC, focusing on those that have the most significant impact on GHG emissions or removals and those impacting key categories in the national GHG inventory.

Developing countries are encouraged to report GHG projections, which are not to be used for progress tracking except where the Party is assessing its GHG emissions against a dynamic baseline.

Source: [Next steps under the Paris Agreement and the Katowice Climate Package](#), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 2019

implementation of measures to prevent, control and reduce emissions of air pollutants and to exchange data on them. This Air Convention is intended to protect the environment against air pollution and to gradually reduce and prevent air pollution, including long-range transboundary air pollution. It is implemented by the European Monitoring and Evaluation Programme (EMEP).

At European level, the Industrial Emissions Directive (IED) is the main EU instrument regulating pollutant emissions from industrial installations. It sets out the main principles for permitting and controlling installations based on an integrated approach and the application of best available techniques (BAT). 'Best Available Techniques' are the most effective techniques to achieve a high level of environmental protection, taking into account the costs and benefits. In its work programme for 2021, the European Commission indicated that it would propose a revision of the Industrial Emissions Directive, as announced in the European Green Deal. The revision will seek to enhance the Directive's contribution to the zero pollution objective, as well as its consistency with climate, energy and circular economy policies.

The 2016 revised version of the National Emission Ceilings Directive (NEC) sets 2020 and 2030 emission reduction commitments for five main air pollutants responsible for acidification, eutrophication, particulate matter formation and ground-level ozone pollution, i.e. sulphur dioxide (SO<sub>2</sub>); nitrogen oxides (NO<sub>x</sub>); fine particulate matter (PM<sub>2.5</sub>), non-methane volatile organic compounds (NMVOCs); and ammonia (NH<sub>3</sub>).

Other important indicators concern the production and use of substances which deplete stratospheric ozone (ODS): total amount produced, sold or consumed in a country. The question is whether and to what extent the emissions of ozone-depleting substances are reduced according to the schedule agreed at the international level. This schedule is laid down in the Vienna Convention for the Protection of the Ozone Layer (1985), its Montreal Protocol on Substances that Deplete the Ozone Layer (1987) and the latter amendments of London, Copenhagen, Montreal and Beijing. The Montreal Protocol sets a target to eliminate the production and use of ODS.

### V4.1.2.2. SOURCES OF DATA

About *emission inventories*, CLRTAP and its eight protocols cover the methodology of data collection on emissions of pollutants into the air. Internationally agreed methodology and standards for estimating air emissions are included in the UNECE Emission Inventory Guidebook developed jointly by EMEP.<sup>(1)</sup> EMEP acts under the CLRTAP and the European Environment Agency's 'Core inventory of air emissions' (EEA CORINAIR). These methods are also linked with the 2019 refinement of the 2006 Guidelines of the Intergovernmental Panel for Climate Change (IPCC), which are the basis for reporting to the United Nations Framework Convention for Climate Change (UNFCCC). The guidebook and the IPCC guidelines are not only used as a reference by EU countries, but also by e.g. ENP East countries (Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine), Kazakhstan and Kyrgyzstan.

In practice, two basic methods for emission inventories are applied in the EMEP guidebook. The first, detailed method is based on direct measurements of emissions. The second method is an estimation based on technological calculations, through the use of proxy statistics like data on production volumes, fuel and raw materials consumption. In this last case, the proxy values are multiplied by an emission factor specific to each pollutant and each type of emission source.

It is recommended to carefully evaluate the contribution of each emission source to the total national emissions, in order to prioritise resources in an efficient way. The Guidelines provides recommendations and advice on methodologies with different levels of accuracy for measuring the emissions from the different sources. Generally, the more rigorous methodological approaches will reduce the uncertainties in the emission inventories. However, these approaches normally also require more resources, thus creating a trade-off between resources and uncertainty. Therefore, it is recommended to allocate more resources to the emission sources with the largest contributions to national emissions, in order to enable more advanced approaches and lowering overall uncertainty in the emission inventories.

Input data and statistics are usually collected at city and regional levels before being aggregated at national level by government bodies in charge of environment, industry, agriculture and transport. They are also collated by the national statistical agencies.

An essential source of data is:

- Information submitted by companies for obtaining environmental exploitation permits;
- Monitoring data on emissions, measured by the companies themselves (self-monitoring) or by the institutions in charge of verifying companies' respect of national emission limits.

As for ozone depleting substances, data collection should cover substances in annexes A–C and E of the Montreal Protocol, whether these exist alone or in a mixture.

<sup>(1)</sup> European Monitoring and Evaluation Programme (EMEP): Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

Data on production, imports and exports of ODS are generally collected annually by national statistical agencies or by national focal points for reporting under the Montreal Protocol.

The UNEP Ozone Secretariat has developed forms for reporting data under the Montreal Protocol. These cover imports, exports, production, amounts destroyed and imports from / exports to countries who are not parties to the Convention. Consumption is calculated as production plus imports minus exports, destroyed quantities, and feedstock uses of a controlled substance. These data are reported in metric tonnes. Data are collected using a variety of methods, including registries or other collections from known producers and consumers, use of estimates and surveys, collecting information through (or from) customs. National figures are used directly, without adjustment.

Within the frame of its Open Data Initiative, the World Bank's Open Data Resources for Climate Change provides freely available climate and climate-related data.

#### To find out more...

- DG Environment: [Air and the Commission's Clean Air Programme](#)
- European Commission: [A Europe that protects: Clean air for all Communication](#)
- European Commission: [Industrial Emissions Directive \(IED\)](#)
- European Commission: [NEC directive](#)
- UNECE: [Guidelines for the Application of Environmental Indicators](#)
- European Monitoring and Evaluation Programme (EMEP) [for long-range transmission of air pollutants in Europe](#)
- EEA: [European Topic Centre on Air Pollution, Transport, Noise and Industrial Pollution \(ETC/ATNI\)](#)
- EEA: [European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation \(ETC/CCA\)](#)
- EEA: [European Topic Centre on Climate Change Mitigation and Energy \(ETC/CME\)](#)
- EMEP: [Centre on Emission Inventories and Projections \(CEIP\)](#)
- United Nations Environment Programme(UNEP): [Ozone Secretariat](#)
- UN Framework Convention on Climate Change (UNFCCC)
- UNECE: [Convention on Long-range Transboundary Air Pollution \(CLRTAP\)](#)
- UNECE: [Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution](#)
- EMEP/EEA: [Air pollutant emission inventory guidebook; Air pollutant emission inventory guidebook 2019 \(EEA Report No 13/2019\)](#)
- EEA: [Environmental indicators: Typology and overview \(Technical report No 25/1999\)](#) introduces the EEA 'Typology of indicators' and the DPSIR framework
- UNEP: [Vienna Convention for the Protection of the Ozone Layer \(1985\)](#)
- UNEP: [Montreal Protocol on Substances that Deplete the Ozone Layer\(1987\)](#)
- Intergovernmental Panel for Climate Change (IPCC)
- World Bank: [Open Data Initiative](#)
- World Bank: [Open Data Resources for Climate Change](#)

## V4.1.3. Air quality indicators

### V4.1.3.1. CONCEPTS AND DEFINITIONS

A clean air supply is essential to our own health and that of the environment. But since the industrial revolution, the quality of the air we breathe has deteriorated considerably - mainly as a result of human activities. Rising industrial and energy production, the burning of fossil fuels and the dramatic rise in traffic on our roads all contribute to air pollution in our towns and cities which, in turn, can lead to serious health problems. For example, air pollution is increasingly being cited as the main cause of lung conditions such as asthma.

Major concerns relate to the effects of air pollution on human health, ecosystems, and buildings, and to their economic and social consequences. Human exposure is particularly high in urban areas where economic activities and road traffic are concentrated. It also happens around industrial zones.

An important source of pollution in many urban areas is fuel combustion in motor vehicles. Further pollution sources are industry and household combustion of fuel (including wood). Generated pollutants include nitrogen oxides ( $\text{NO}_x$ ), carbon monoxide (CO), sulphur dioxide ( $\text{SO}_2$ ), volatile organic compounds (VOCs), particulate matter ( $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  depending on their size) and heavy metals such as lead. On warm summer days the strong sunlight leads to a build-up of ground-level (or tropospheric) ozone ( $\text{O}_3$ ). Ozone is formed through the reaction between other pollutants (oxidation of volatile organic compounds (VOCs) such as benzene in the presence of nitrogen oxides). However, due to the special atmospheric chemistry of ground-level ozone, levels are very often lower in urban areas than in the countryside.

Nowadays a major challenge in many urban zones is to further reduce emissions of local and regional air pollutants in order to achieve stronger decoupling of emissions from GDP and to limit the exposure of the population to air pollution. This implies implementing appropriate pollution control policies, technological progress, energy savings and environmentally sustainable transport policies.

The key indicators in this domain are related to ambient air quality in urban areas, i.e. the concentration of the above mentioned air pollutants. The main pollutants monitored are ground-level ozone, particulate matter ( $\text{PM}_{10}$  and  $\text{PM}_{2.5}$ ), sulphur dioxide, nitrogen dioxide and lead. Carbon monoxide, volatile organic compounds including benzene (VOCs) can also be considered. Box V4.1.3 details the key aspects of monitoring data and indicators.

#### Box V4.1.5: Monitoring data and indicators

The collection and analysis of environmental data is necessary to provide objective, reliable and comparable information that shall enable actions needed to protect the environment and to ensure transparency in relation to the public.

Primary data are data obtained from monitoring activities. Environmental monitoring generates huge amount of these primary data. An example is the hourly measured concentrations of pollutants in the air: measuring one pollutant on an hourly basis at one station over one year generates 8 760 data points. As such, these data have very limited or “neutral” information value: one isolated data just tells what was the concentration of one pollutant at a certain time and at a certain location. In order to get more information, these primary data must be processed, aggregated and analysed in order to produce statistics and indicators. An indicator may simply be a selected statistic (like percentiles or mean values) or an aggregation of several statistics: for example, an air quality index.

While primary data have relatively low information content, indicators are not “neutral”: they are linked to defined environmental management issues and allow evaluating or assessing the situation. Using for this assessment the DPSIR framework used by the EEA ensures that issues are handled in a comprehensive way and that all important aspects are covered.

Unit of measurement is  $\mu\text{g}/\text{m}^3$ , ppm or ppb, as appropriate.

Knowing the concentrations of pollutants allows verification of whether limit values fixed to protect human health and/or ecosystems are exceeded, as well as estimation of the exposure of ecosystems to acidification, eutrophication and ozone. The number of exceedances of limit values and exposure assessment are additional indicators included in the EEA indicators.

The indicators on ambient air quality in urban areas are also closely linked to other indicators which relate to causes and sources of pollutants, effects (e.g. on health) and societal responses. These include, for example, the indicators on population growth rate, rate of growth of urban population, percent of population in urban areas, annual energy consumption per capita, emissions of sulphur oxides and nitrogen oxides, life expectancy at birth, share of consumption of renewable energy resources.

At European level, the environmental quality of ambient air and monitoring falls mainly under the Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC), which requires air quality monitoring and the achievement of air quality objectives. Several annexes of the CAFE Directive was amended in 2015.

World Health Organization (WHO) air quality guidelines exist for all the pollutants mentioned above. Many countries have established their own air quality standards for many of these pollutants.

**Box V4.1.6: Establishing an Integrated Ambient Air Quality Monitoring Framework (IAAQMF) and Developing an Air Quality Index (AQI) for Mauritius (2010)**

With the continually sustained economic growth in Mauritius, the Ministry of the Environment & NDU (National Development Unit) registered an increase in number of complaints with regards to air pollution. Moreover, with the advent of waste-to-energy power plants projects in the energy sector, baseline data for other important air pollutants such as Dioxin and Furans needed to be established.

The data obtained is an essential tool for the Government of Mauritius in policy decision making.

The Department of Environment needs to monitor the air quality around the island over a 24 hrs basis with the use of an Integrated Ambient Air Quality Monitoring Framework (IAAQMF) comprising of fixed and mobile stations linked through a central network system. Two mobile ambient air monitoring stations were acquired for measurement of Particulate Matter (PM 10, PM 2.5 and Total Suspended Particles) and gaseous contaminants (Sulphur Dioxide, Oxides of Nitrogen and Carbon Monoxide).

The IAAQMF has enabled the Department of Environment to develop an Air Quality Index (AQI) for Mauritius, which informs the public about the air quality and the level of pollution, including the associated health hazards.

With the introduction of an Air Quality Index (AQI), the citizens of Mauritius are better informed about the quality of air they are breathing. The latter applies also to the tourism sector (i.e. Eco-tourism or Sustainable tourism) as well as the Integrated Resort Scheme (IRS).

The following specific actions were achieved:

- To carry out an analysis of the existing ambient air monitoring system;
- To develop an Air Quality Index for Mauritius;
- To establish a data management system for the AQI.
- To propose a mechanism for the implementation of the IAAQMF;
- To develop a 5-year strategic plan, including financial, technical, human resource requirements, policy and structural reforms with time schedules

By establishing an Integrated Ambient Air Quality Monitoring Framework (IAAQMF), the Ministry is in a better position to effectively execute its roles and functions as Enforcing Agency for Air Quality, as Mauritius seeks to be recognized internationally as a country where the ambient air quality is good and safe for living.

Source: Mauritius, the Ministry of Environment & NDU

**V4.1.3.2. SOURCES OF DATA**

In many countries, data on ambient air pollution concentrations is routinely collected by national or local monitoring networks which include several monitoring stations where samplings (and measurements in case of automatic stations) are made. Most of the time, these networks are managed by public authorities at the national, regional or municipal levels. At the national level, monitoring of air quality and its management falls under the responsibility of the Ministry of the Environment or the Ministry for Health and their agencies. Data can also be collected for research purposes by universities and research institutes. In addition, industries can be obliged to monitor air quality in their surrounding area in accordance with the obligations specified in the environmental permit granted by the competent authorities.

Monitoring stations can be classified according to the main sources of pollution affecting air quality in their surroundings (mainly industrial, traffic or background oriented stations). They can be located in urban, suburban or rural zones. Monitoring data must be representative both in terms of time representativeness (i.e. covering a representative time period) and of spatial representativeness (i.e. representing a significant area and/or population exposure).

Indicators aggregating the monitoring data may be designed and constructed in a number of ways. Examples of statistics used for air quality indicators are: the annual mean and percentiles values, the number of days or hours with concentration exceeding a certain value, etc. Where monitoring data are unavailable, estimates of pollution levels may be made using air pollution models or other methods (e.g. monitoring campaigns with diffusion tubes, bio-indicators etc.).

Air quality data and statistics from the EU Member States and from other associated countries are compiled in the Air Quality database, a database maintained by the EEA with the assistance of the thematic centre on air and climate change (ETCACC).

**To find out more...**

- European Commission, DG Environment: [Air policy](#)
- European Commission: [Ambient Air Quality Framework and Cleaner Air for Europe \(CAFE\) Directive \(2008/50/EC\)](#) and associated legal texts
- European Environment Agency: [Air Pollution](#)
- European Topic Centre on Climate Change Mitigation and Energy (ETC/CME)
- EEA/EIONET: [Air Quality database - European official air quality data](#)
- United Nations Environment Programme: [Urban Air Quality Management Toolkit](#)
- WHO: [Air quality guidelines](#)

## V4.1.4. Water – statistics on emissions to water and water resources

### V4.1.4.1. CONCEPTS AND DEFINITIONS

Key environmental indicators in this environmental sector are:

- A. Renewable freshwater resources
- B. Freshwater abstraction
- C. Household water use per capita
- D. Water losses
- E. Reuse and recycling of freshwater
- F. Polluted (non-treated) wastewaters
- G. Water quality in urban areas (covered in a separate chapter)

**Renewable fresh water resources** are defined as the total volume of river run-off and groundwater generated under natural conditions, exclusively by precipitation within the country, and the actual flow of rivers and groundwater coming from neighbouring countries. The measurement units are million cubic metres (m3) per year.

The development of this indicator provides a measure of the state of renewable freshwater resources in a country.

The total volume of surface and ground freshwater abstracted annually is another indicator: total, by economic activity (in accordance with ISIC) and as a percentage of renewable freshwater resources (the country's water exploitation index, or WEI). The indicator provides, in relation to total resources available for abstraction, a measure of the pressure on the environment in terms of abstraction of freshwater resources. It can reflect the extent of water resource scarcity and the distribution of abstracted water among different economic activities.

Since water quality is often linked to water quantity - e.g. flow or volume affects quality by influencing concentration of pollutants - the relation of freshwater abstraction to renewal of stocks is a central issue in sustainable freshwater resource management. The indicator can show to what extent freshwater resources are already used and any need to adjust supply and demand management policy. Changes in the WEI help to analyse how changes in abstraction affect freshwater resources by increasing pressure on them or making them more sustainable. The WEI threshold that distinguishes non-stressed regions from stressed ones is around 20%. Severe water stress can occur where the WEI exceeds 40%.

Main concerns relate to the inefficient use of water and to its environmental and socio-economic consequences: low river flows, water shortages, salinization of freshwater bodies in coastal areas, human health problems, loss of wetlands, desertification and reduced food production. Pressures on freshwater resources are exerted by overexploitation and by degradation of environmental quality.

Household water use per capita is the quantity of water used to cover the household and related utility needs of the population. The unit is cubic metres per year and per capita (or litres/day per capita). This indicator provides a measure of the pressure on the environment in terms of water abstraction from different water sources. The indicator – to be considered in relation with available resources - is one of the major ones defining the level of development of water economy services and the degree of water accessibility to cover all household needs of the population. This indicator helps identify trends in rational water use in a particular location.

Water losses are defined as the quantity and percentage of freshwater lost during transport (owing to leakage and evaporation) between a point of abstraction and a point of use. The amount of water lost during transport to users is an indicator of the efficiency of a water management system, including technical conditions affecting water supply pipelines.

The share of reused or recycled water in the total volume of water used to cover production needs defines the percentage of water saved by applying recycling and reused water supply systems as a national total and broken down by economic activities.

At the international level, the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, more simply known as the 'Water Convention', requires that the parties introduce sustainable water management, including an ecosystem approach and the rational and fair use of transboundary waters. In the European Union, the Water Framework Directive obliges the Member States to promote sustainable use based on long-term protection of available water resources and to ensure a balance between abstraction and recharge of groundwater, with the aim of achieving "good groundwater status".

### V4.1.4.2. SOURCES OF DATA

Renewable freshwater (surface and groundwater) resources are replenished by precipitation (less evapo-transpiration) falling on a country's territory that ends up as runoff to rivers and recharge to aquifers (internal flow), and by surface waters and groundwater flowing in from other countries (inflow). Climatic, ecological, economic and other limitations on the availability of these resources for abstraction are reflected in the variable "regular freshwater resources 95 per cent of the time". Data on renewable freshwater resources are usually collected at selected hydrological stations both at the national level and at the levels of main river basins. The values are calculated on the basis of long-term measurements of levels, flow rates and inflows/outflows carried out on rivers and lakes as well as groundwater horizons and countrywide precipitation. The indicator is the major one used to define the water balance of a country.

Water is abstracted by public or private bodies whose main function is to provide water for various uses (the "public water supply"). It can also be directly abstracted from rivers, lakes, wells or springs by industries, farmers, households and others for their own use (self-supply). The indicator incorporates data

on abstraction of freshwater, broken down according to the main activity of the water abstractor as defined by ISIC/NACE. The water abstraction indicator calculations are based on the data on quantity of abstracted water reported by water users to the relevant authorities. The quantity of water abstracted is either measured or calculated on the basis of energy consumption for pumps. In some cases it is necessary to apply a calculation method using models for some water users (household and agriculture).

The WEI (Water Exploitation Index) is the ratio of annual total water abstraction to long-term annual average renewable freshwater resources, expressed as a percentage. The WEI provides a good national-level overview of the pressures on resources in an easily understandable format, and it shows trends over time. Data and information concerning the use of WEI in African countries are available in the IPCC's Assessment Reports on Climate Change.

Household water use per capita can be determined based on the measured volume supplied mainly through the public water supply systems. The use of water by the population that is not supplied by public water supply systems needs to be calculated. Households' water use per capita is calculated by dividing total water consumption in the community by the respective number of inhabitants. The indicator is based on data submitted by associations, enterprises and organizations supplying households with water and by local public administration bodies.

In many countries around the world, data on household water use are still collected by the government branch dealing with housing and municipal services. WHO and UNICEF collect estimates of national average figures from governments as part of its Joint Monitoring Programme (JMP) for water supply and sanitation. The JMP indicators feed into the SDG indicators framework, informing Sustainable Development Goal 6 'Ensure Availability and Sustainable Management of Water and Sanitation for All'.

When working with water losses, the most important issue is to have data on the quantities of freshwater lost from water supply systems between a point of abstraction and a point of use due to leakage or evaporation. The indicator is estimated and defined as the absolute and relative difference between the amount of water abstracted and the amount delivered to users (households; agriculture, forestry and fishing; manufacturing, the electricity industry and other economic activities).

Data on reuse and recycled water are collected from state statistical reporting by enterprises and other organizations. Data on waste water treatment can also be obtained from municipalities.

In general, data quality can be considered to be fairly good.

Guidance can be found at the international level in the WMO Guide to Hydrological Practices and in the EEA/ Eurowater Quantity - technical guidance for implementation. Additional information can also be found in the UNSD/UNEP Questionnaire on Environment Statistics, coordinated with the relevant OECD and Eurostat Joint Questionnaire. The OECD/ Eurostat Data collection Manual provides guidance, best

practice and standards, estimating and compiling data for the Joint Questionnaire on Inland Waters.

The Living Standards Measurement Study - Integrated Surveys on Agriculture (LSMS-ISA) has issued a guidance note called 'Improving Household Survey Instruments for Understanding Agricultural Household Adaptation to Climate Change: Water Stress and Variability'. This note focuses on improving household survey instruments for understanding how agricultural households adapt to weather variability, caused by global climate change. It also outlines instruments for measuring local water resources, including rainfall, surface water, and groundwater.

#### To find out more...

- DG Environment: [Water](#)
- European Commission: [Water Framework Directive \(WFD\)](#)
- EEA European Topic Centre on Inland, Coastal and Marine waters (ETC-ICM)
- Food and Agriculture Organization (FAO): [AQUASTAT database](#)
- UNSD/UNEP Questionnaire on Environment Statistics (waste and water)
- OECD Environmental Data Compendium - Inland Waters section
- World Meteorological Organization: [Global Hydrometry Support Facility \(WMO HydroHub\)](#) and [World Hydrological Cycle Observing System \(WHYCOS\)](#)
- World Meteorological Organization: ['Guide to Hydrological Practices'](#) (2008; updated 2020)
- LSMS-ISA: ['Improving Household Survey Instruments for Understanding Agricultural Household Adaptation to Climate Change: Water Stress and Variability'](#) (2011)
- UNECE: [Convention on the Protection and Use of Transboundary Watercourses and International Lakes \(Water Convention\)](#)
- IPCC: [Assessment Reports on Climate Change](#)
- JMP: [Global estimates for WASH](#)
- JMP: [Monitoring methods](#)
- EEA: [Water and marine environment](#)
- EEA: [Water Information System for Europe \(WISE\) - Freshwater](#)
- EEA: [Eurowater Quantity - technical guidance for implementation](#)
- Joint Research Centre (JRC): [Desertification and drought and Floods](#)
- European Flood Awareness System (EFAS)
- OECD/Eurostat: [Data Collection Manual for the OECD/Eurostat Joint Questionnaire on Inland Waters and Eurostat regional water questionnaire](#)
- World Bank: [Living Standards Measurement Study - Integrated Surveys on Agriculture \(LSMS-ISA\)](#)

## V4.1.5. Water quality indicators

### V4.1.5.1. CONCEPTS AND DEFINITIONS

Water quality is about what is in water and how quality affects its usefulness.

Water is a precondition for human, animal and plant life as well as an indispensable resource for the economy. Water also plays a fundamental role in the climate regulation cycle.

Rivers have often been treated unwisely as a convenient way of transporting waste to the sea, affecting the biodiversity of thousands of kilometres of waterways, harming human health, and in the end polluting coastal and marine waters. Protection of water resources, of fresh and salt water ecosystems and of the water we drink and bathe in is therefore one of the cornerstones of environmental protection. The stakes are high and the issues transcend national boundaries and concerted action between countries is very often necessary to ensure an effective protection of water basins.

Key water quality indicators are:

- A. Indicators related to drinking water quality
- B. BOD (biochemical oxygen demand) and concentration of ammonium in rivers
- C. Nutrients in freshwater
- D. Nutrients in coastal seawaters

Water for drinking should be free of disease-causing microorganisms, harmful chemicals, objectionable taste and odour problems, and excessive levels of colour and suspended material.

Since many water supplies receive no treatment, it is important that the indicator reflects the effectiveness of management of the whole water supply system including the water catchment, storage and distribution system.

The indicator provides a measure of the risk of negative impacts of poor drinking water quality on human health and shows the extent to which the drinking water supply conforms to sanitary requirements and standards. The EU Drinking Water Directive (98/83/EC) sets standards for the 48 most common parameters, based on the WHO guidelines, including selected microbiological and chemical quality parameters are measured.

Commonly measured parameters of water quality are: total coliforms, thermo-tolerant coliforms, nitrate, trihalomethanes, heavy metals, pesticides, acidity (pH), aluminium, colour, turbidity, total dissolved salts, hardness, iron, manganese. For each parameter, the proportion of drinking water samples analysed that fail to comply with the relevant standards is calculated.

BOD and concentrations of ammonium in rivers provide a measure of the state of rivers in terms of biodegradable organic load and ammonium ( $\text{NH}_4^+$ ). BOD is a key indicator, expressing the amount of oxygen consumed by organisms in water and sediment to break down organic matter present in the water. Ammonium concentration also exerts a demand on oxygen in water as it is transformed to oxidised forms of

nitrogen. It is toxic to aquatic life at certain concentrations (in relation to water temperature, salinity and pH). High BOD and ammonium concentrations are usually a result of organic pollution, caused by direct discharge of wastewater, discharges from wastewater treatment plants, industrial effluents and agricultural run-off.

In most European countries, the BOD5 test is used (oxygen consumption is measured after 5 days incubation under controlled conditions). In other countries, the BOD7 test is used (samples are incubated for 7 days). Annual average BOD is expressed in  $\text{mg O}_2$  consumption per litre and annual average total ammonium concentrations in micrograms of nitrogen per litre. Information on the quality of surface waters in terms of substances which cannot be degraded biologically (or chemical oxygen demand - COD) could be considered as well.

Nutrients in freshwater provides a measure of state of freshwater (rivers, lakes and groundwater) in terms of nutrient concentration (phosphates and nitrates). Large inputs of nutrients to freshwater bodies from urban areas, industry and agricultural areas can lead to eutrophication of water bodies with subsequent oxygen depletion. As for high BOD and ammonium concentrations, this causes ecological changes that can result in a loss of plant and animal species and have negative impacts on the use of water for human consumption and other purposes. Concentrations of nitrates are expressed as  $\text{mg of nitrates/litre}$ , and concentrations of phosphate and phosphorus as  $\text{mg of phosphorus/litre}$ .

Nutrients in coastal seawater provide a measure of the state of coastal seawaters in terms of nutrient concentrations. Nitrogen and phosphorus enrichment can result in a chain of undesirable effects, starting with excessive growth of plankton algae, which increases the amount of organic matter settling to the bottom. The consequent increase in oxygen consumption can lead to oxygen depletion, changes in community structure and death of the benthic fauna. Eutrophication can also increase the risk of algal blooms, some of them consisting of harmful species. Concentrations of major biogenic substances are expressed in  $\text{mg/litre}$ .

At European level the environmental quality of surface waters with respect to organic pollution reflected by the BOD and ammonium as well as the reduction of the loads and impacts of these pollutants are objectives of several directives including: the Drinking Water Directive (98/83/EC) which sets standards for BOD and ammonium content of drinking water; the Nitrates Directive (91/676/EEC) aimed at reducing nitrate and organic matter pollution from agricultural land; the Urban Waste Water Treatment Directive (91/271/EEC) aimed at reducing pollution from direct discharge of untreated or insufficiently treated wastewater, from sewage treatment works and certain industries; the Industrial Emissions Directive (IED) aimed at controlling and preventing the pollution of water by industry; and the Water Framework Directive (2000/60/EC) which requires the achievement of good ecological status or good ecological potential of rivers across the EU by 2015.

### Box V4.1.7: The Limpopo River Basin – Monitoring of water quality

The Limpopo River Basin is shared by four SADC Member States; Botswana, South Africa, Zimbabwe and Mozambique. The basin covers different climatic and topographic zones and land use types, including protected areas. The four countries co-operate in managing their water resources through the Limpopo Water Course Commission (LIMCOM). An on-line tool, the Limpopo River Awareness Kit, has been designed to support capacity development in LIMCOM and raise awareness for trans-boundary water issues in southern Africa.

As the river basin passes through various geographical regions and biomes and supports a wide array of water demands, there is a great need for Integrated Water Resources Management (IWRM). IWRM is challenging, even more so in a trans-boundary setting. At a basin or sub-basin scale, the priority is often on monitoring and management of water quantity. However, the monitoring and management of water quality is equally important.

Maintaining water quality is critical for communities throughout the Limpopo River basin. Protection of water quality in the river system directly or indirectly contributes to the achievement of several Millennium Development Goals (MDGs) and their associated targets:

- Eradicate extreme poverty and hunger;
- Reduce child mortality;
- Combat disease, including HIV/AIDS, malaria, and waterborne diseases;
- Ensure environmental sustainability: halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.

Monitoring plays a crucial role in determining sustainable abstraction volumes, the feasibility of developments, and strategy for efficient overall resource management. Meteorological and hydrological data collection is done at the national level, primarily for use at the national level. One recommendation is to develop a trans-boundary monitoring network, including a comprehensive surface water and groundwater monitoring program consistent in quality.

A key issue is freshwater quality: While there is often a focus on water quantity (maintaining dam volumes, stream flow, water supply, etc.), less attention has been paid to water quality, especially to policy instruments to protect and manage this critical aspect of freshwater. River runoff comprises the most essential data for water resources management.

The overall water quality situation in the Limpopo River basin is described as impacted, but not severe. Land use management and developments within this basin have altered water quality when compared with the baseline/un-impacted conditions. Water resources in most of the sub-catchments in the Limpopo River basin are impacted by the following (Ashton et al, 2001):

- Mining and minerals processing. As the Limpopo River basin includes numerous mines, active and abandoned, the environment is under significant threat from acid mine drainage; the metals and chemicals typically found in acid mine drainage can cause serious illnesses in humans and animals;
- Non-point impact from commercial or subsistence agriculture, irrigation and redistribution of river waters;
- Erosion. Soil erosion, resulting from poor tillage and land use management can result in an increased sediment load in rivers, as soils and sediments wash away during heavy or sustained rainfall events;
- Uncontrolled and wild landfills and solid waste disposal sites;
- Disposal of liquid and effluent, fuel loss and litter on roadways;
- Non-point domestic effluent via soak-aways in rural areas.

Another issue is groundwater quality: The impacts of changes in surface water quality can often be seen directly and the causal chain is often clear. It is not always evident where impacts on groundwater quality originate. However, it is equally important as it is often used for drinking water and domestic consumption. One of the primary sources of human-caused groundwater pollution in urban areas is leakage from pit-latrines in areas with poor sanitation. Agriculture (irrigated cultivation and livestock) is another important source of groundwater contamination because of the pesticides, herbicides and fertilizers used.

Source: [Limpopo River awareness kit \(water quality\)](#).

### V4.1.5.2. SOURCES OF DATA

Data on water quality is often routinely collected by national or local monitoring networks at several sites where sampling is made. Chemical analyses are carried out in laboratory.

In most countries, the agency responsible for the surveillance of drinking-water supply services is the Ministry of Health (or a public health agency) and its regional or departmental offices. In some countries, it may be an environmental protection agency. Local environmental health authorities also often play an important role in managing water resources and drinking-water supplies.

Besides drinking water, water quality monitoring is usually under the responsibility of the Ministry of the Environment or the Ministry in charge of water management and their agencies. In practice implementation is done by several institutions.

Monitoring data must be representative both in terms of time representativeness (i.e. adequate sampling frequency) and of spatial representativeness (i.e. representing average conditions). Monitoring must also reflect the hydrological importance of particular rivers, lakes and groundwater zones.

Data are aggregated and generally presented in the form of tables which include the annual average concentrations of BOD and ammonia, of nitrates, phosphates, total phosphorus and total nitrogen, compared with national water quality standards or international water quality targets (relevant sea-related conventions or national targets).

Data on drinking water quality are usually presented in the form of a table which consists of selected microbiological and chemical quality parameters measured, the total number of samples, the number of non-compliant samples and the percentage of non-compliant samples in each category.

The UNSD International Environment Statistics Database provides some data transmitted by national statistical agencies.

International Recommendations for Water Statistics (IRWS) were developed to assist countries establish and strengthen information systems for water, which in turn support the design and evaluation of better water policies for Integrated Water Resources Management (IWRM). Among others, these recommendations provide the necessary information for deriving coherent and consistent indicators, enabling comparisons over time and between countries from an agreed list of data items.

The data received from countries, together with data from other sources, feed into UNSD's evolving environment statistics database.

At the European level, the Water Information System for Europe – or more commonly known as WISE – is the European gateway to information on European water issues. It compiles a number of data and information collected at EU level by various institutions and bodies.

#### To find out more...

- European Commission, DG Environment: [Water Policy](#)
- European Commission: [Water Framework Directive \(2000/60/EC\)](#)
- European Commission: [EU Drinking Water Directive \(98/83/EC\)](#)
- European Commission: [Nitrates Directive \(91/676/EEC\)](#)
- European Commission: [Urban Waste Water Treatment Directive \(91/271/EEC\)](#)
- European Commission: [Industrial Emissions Directive \(IED\)](#)
- European Environment Agency (EEA): [Water quality](#)
- EEA: [EEA European Topic Centre on Inland, Coastal and Marine waters; Oxygen consuming substances in rivers](#)
- World Health Organization (WHO): [Guidelines for drinking-water quality; Water quality monitoring](#)
- UNEP/UNECE: [Guidelines for the Application of Environmental Indicators](#)
- United Nations Statistics Division: [Environment Statistics Section](#)
- Sustainable Development Goal 6 'Ensure availability and sustainable management of water and sanitation for all' and its indicators in the [Global SDG Indicators Database](#) (indicators 6.1.1 to 6.b.1)
- FAO: [AquaStat – FAO's information system on water and agriculture](#)
- International Organisation for Standardization (ISO) [water quality standards](#)
- UNEP: [Water Quality Index for Biodiversity \(WQIB\)](#)
- European Commission/EEA: [Water Information System for Europe \(WISE\)](#)
- [UNSD International Recommendations for Water Statistics \(IRWS\)](#)

## V4.1.6. Waste – statistics on waste generation, movements of hazardous wastes, recycling and disposal

### V4.1.6.1. CONCEPTS AND DEFINITIONS

Key environmental indicators in this environmental sector are (UNECE classification):

- A. Waste generation
- B. Transboundary movements of hazardous wastes
- C. Waste reuse and recycling
- D. Final waste disposal

Waste generation is the amount of waste generated in a country – in total, per unit of GDP, by sector (industrial and municipal solid waste) and by negative impact (hazardous waste). It is expressed in million metric tonnes per year.

Total waste intensity should be presented in kilograms per unit of GDP at constant prices; municipal waste intensity should be expressed in kg per capita or in m<sup>3</sup> per capita. It can also be presented in terms of waste (kg) generated per unit of production (tonne, kWh, etc.)

The waste intensity represents a driving force indicator and shows response to anthropogenic activities. Waste generated per unit of GDP (total waste intensity) shows whether there has been any decoupling of waste generation from economic growth. Municipal waste generation per capita allows comparisons of countries. For each indicator, the two time series should be shown together (i.e. on total waste generation and on development of GDP, on municipal waste generation and on the number of population) to get the full benefit of the indicator.

#### Box V4.1.8: Evaluation of composition of waste and routine data collection

##### Pilot Study implemented by the EU CARDS project 'Development of a National Environmental Monitoring System for Bosnia and Herzegovina (RANSMO)'

The amount of waste generated within a municipality in Bosnia and Herzegovina is established by estimation. The best method of establishing waste density is by the use of a weighbridge. However, very few municipalities have a mechanism for bulk weighing, let alone a weighbridge at the dump site. In addition, density does not give you total volume – which is necessary for evaluation of the long-term capacity of the landfill site.

Each municipality has its own methodology for estimating waste volumes. The three most common methods used, which each have significant limitations, are:

- **Number of containers collected x size of container = volume**  
Compaction is rarely performed at the container level, so a container could be filled by a very small amount of waste (i.e. empty boxes). This would give an inaccurate result of total volume of waste produced.
- **Number of truck collections performed x size of collection vehicles = volume**  
Compaction is rarely performed at the truck level, so a truck could be filled by a very small amount of waste (i.e. empty boxes). This would give an inaccurate result of total volume of waste produced.
- **Estimated volume x estimated density for generic (household or industrial) waste = tonnes**  
The density of waste varies greatly dependent on what it is (e.g. plastic is lighter (less dense) than sawdust). Using a single figure to calculate waste density without knowing the type of waste present would give an inaccurate total density of waste produced.

A pilot study was undertaken to evaluate different methods of assessing household waste generation by Communal Enterprises as well as looking at the different types of waste arising from different generators (households, schools and institutions). The approach was based on the need to provide better information on the composition of waste, to allow a more accurate calculation of volume and density, and to establish better mechanisms for treatment, recycling and compliance to legislative requirements.

Three methods for the evaluation of composition were therefore used:

- Simple questionnaires completed by the driver/ collectors of waste
- Separation of waste at source in a "controlled" (i.e. school or hospital) environment
- Physical sorting exercises performed on collected wastes at the landfill.

The pilot study was implemented in 14 municipalities. They were chosen to be representative of the overall socio-cultural context. This ensures that the results can be interpolated to the whole country. Each study was performed twice, to cover the winter and summer periods, as seasonal influences are perceived by municipality staff to be very pronounced.

The specific methodologies implemented for assessment of wastes from each of the different producers (households, schools and medical facilities) were designed to gather data on:

- **Composition of wastes** from a given source
- **Volume** of each waste type
- **Weight** of each waste type
- **Density conversion factor** of volume to weight for a given waste type. This is particularly useful for estimation of Municipal Solid Wastes (domestic type wastes) as the lack of compaction vehicles yields a MSW density different to those in countries that have many compaction vehicles.

Transboundary movements of hazardous wastes relate to the total amount of hazardous waste, expressed in metric tonnes per year, exported and imported by a country. Trends in a country's export of hazardous waste show its response to the need to minimize the generation of hazardous waste and to reuse or recycle it domestically. Toxic, explosive, oxidizing, corrosive, flammable, irritant, teratogenic, mutagenic, carcinogenic, ecotoxic and infectious waste are recognized as hazardous waste.

Waste reused or recycled as a share of the total waste in a country – in total, by sector (industrial and municipal solid waste) and by negative impact (hazardous waste) is another indicator. Waste reuse and recycling is an important component of sustainable use of resources in general and of sustainable solid waste management in particular.

Final waste disposal is the share of the total amount of waste generated – in total, broken down by sector and broken down by negative impact – that is finally disposed of by incineration (without energy recovery or use as a fuel) or land filling on a controlled site. The indicator provides a measure of the pressure on the environment and the response to the efficiency of the waste management system.

In the EU, the Waste Framework Directive provides for increased efforts to prevent and reduce waste generation, recover wastes and develop new techniques for final disposal of waste. The European Union's approach to waste management is based on three principles: waste prevention; recycling and reuse; improving final disposal and monitoring.

#### **V4.1.6.2. SOURCES OF DATA**

The precise definition of what constitutes waste varies. According to the Basel Convention, whose framework agreements were also signed by several developing countries (e.g. Afghanistan, Senegal, Nigeria, Indonesia, Trinidad and Tobago), wastes are substances or objects which are disposed of, are intended to be disposed of, or are required to be disposed of by the provisions of national law. Principally, waste is materials that are not primary products (i.e. produced for the market), for which the generator has no further use, and discards, intends to discard or is required to discard. Waste statistics should group waste according to main economic activities (ISIC).

Industrial waste covers waste generated by mining and quarrying, manufacturing industries, energy production and construction. Waste from industrial activities that is removed by municipal waste collection should be reported under the respective sector of generation.

Municipal solid waste includes all municipal waste collected plus the estimated amount of municipal waste from areas not served by a municipal waste collection service.

The amount reported under "total waste generation" should be equal to the sum of the waste amounts reported as industrial waste, waste generated by other economic activities (e.g. agriculture and forestry) and municipal solid waste. Hazardous waste includes those of the above-mentioned

categories which should be controlled according to the Basel Convention.

Data on the generation of industrial waste are usually collected by authorities responsible for the environment or by NSIs, while data on municipal waste generation are collected by NSIs. Countries report data on internationally agreed types of hazardous waste to the Secretariat of the Basel Convention and waste generation data to UNSD in their response to the UNSD/UNEP Questionnaire on Environment Statistics.

Data on municipal waste collected are usually gathered through surveys of municipalities or from transport companies that collect waste and transport it to a disposal site. Such surveys deliver fairly reliable data. However, amounts of waste will vary, depending on the extent that municipal waste collection covers small industries and the services sector. Waste collected by the informal sector, waste generated in areas not covered by the municipal waste collection system or illegally dumped waste, are not included. Caution is therefore advised when comparing countries.

Data on transboundary movement of hazardous wastes are collected by customs offices and by environmental protection authorities in frontier areas. The most reliable and complete information can be obtained from Basel Convention focal points or competent authorities, which are responsible for reporting to the Convention secretariat. Some horizontal information, also for a number of developing countries, is available on the Internet site of the United Nations Statistics Division.

Reuse and recycling is defined as any reprocessing of waste material in a production process that diverts it from the waste stream, except reuse as fuel (energy recovery). Assessment of reused and recycled waste requires precise assessment of total waste and the specific category of waste (industrial, municipal or hazardous). The indicator of waste reuse and recycling is derived by dividing the quantity of waste reused and recycled by the total quantity of waste and specific-category waste generated. For municipal waste, the proportion of reused and recycled waste may be presented as a percentage of reused and recycled components, such as metals, plastic, paper, glass, textiles or organic materials. Data on reuse and recycling of waste are usually collected by ministries responsible for urban affairs and the environment and by NSIs.

To measure the proportion of waste disposed of by different methods, a combination of several methods can be used. Data on final disposal of waste are collected by ministries responsible for urban affairs and environment and by NSIs. Data on generation and disposal of industrial waste are usually collected by the authorities responsible for the environment, while data on municipal waste generation and disposal are collected by NSIs.

The UNSD/UNEP Questionnaire on Environment Statistics provides a methodology for calculating waste generation by sector, for calculating waste reuse and recycling as well as for calculating final disposal. The Basel Convention has established an internationally agreed methodology for calculating the amount of hazardous waste generated.

### To find out more...

- European Commission - DG Environment: [Waste and recycling](#)
- European Commission: [Waste Framework Directive](#)
- European Environment Agency: [Environment indicators \(including waste indicators\)](#)
- [Basel Convention](#)
- EEA European Topic Centre on Waste and Materials in a Green Economy (ETC/WMGE)
- Eurostat: [Waste statistics](#)
- UNSD and UNEP: [Questionnaire on Environment Statistics \(waste and water\)](#)
- OECD: [Resource productivity and waste](#)
- OECD: [Extended Producer Responsibility - Updated Guidance for Efficient Waste Management](#)
- OECD: [Sustainable Materials Management \(SMM\)](#)
- UNSD: [International and regional environment data sources](#)

## V4.1.7. Biodiversity and protected areas

### V4.1.7.1. CONCEPTS AND DEFINITIONS

Indicators on biodiversity and protected areas are a vital part of environment statistics. The protected areas indicator shows the areas of land, water surfaces and adjacent air layer protected in compliance with national legislation. It includes the area of highly protected territories and their share in the total area of the country. Additional indicators can be developed for the categories of natural territories which have a special World Conservation Union (IUCN) status and for the national categories of protected areas to demonstrate their respective extent and share in the total area of the country. The indicator is expressed as total area in km<sup>2</sup> and as a percentage of the total country territory as well as by IUCN category.

The indicator provides a measure of the response to the degradation of ecosystems and the loss of biodiversity in a country. It demonstrates the extent to which areas important for conserving biodiversity, cultural heritage, scientific research (including baseline monitoring of processes in the ecosystems), recreation, natural resource maintenance and other environmental values are protected from incompatible uses.

Sustainable development depends on a sound environment, which in turn depends on ecosystem diversity. Protected areas, especially the full range of IUCN Protected Area Categories, are essential for conserving biodiversity and contributing to sustainable development.

Measures to conserve or restore biodiversity are taken at different geographical and policy levels (international, regional and national). These measures may have different criteria and objectives but can be complementary. Thus the indicator concentrates on the trends of designated areas according to

these different policy instruments and how effective they are in reaching objectives (sufficiency index).

At the international level, the United Nations Convention on Biological Diversity (CBD) aims at the establishment and maintenance of comprehensive, effectively managed and ecologically representative national and regional systems of protected areas. Recommendation 16 of the Fourth World Congress on National Parks and Protected Areas establishes a target of 10% protected areas for each biome (major ecosystem type).

In 2011, the UN declared 2011-2020 the UN Decade on Biodiversity and adopted the CBD Strategic Plan for Biodiversity 2011-2020. The Biodiversity Indicators Partnership (BIP) supports the development and use of indicators on biodiversity. It actively supported the implementation of the Strategic Plan 2011-2020 and the efforts to achieve the Aichi Targets on Biodiversity. In response to the disappointing results of these efforts, a renewed post-2020 global biodiversity framework is under preparation.

The Biodiversity Indicators Partnership coordinates and supports the development of biodiversity indicators at global, regional and national scales, which included indicators to monitor progress towards the Aichi Targets. The Biodiversity Indicators Partnership has mapped the global biodiversity indicators to the Sustainable Development Goals (SDGs) indicators, based on global indicator reviews conducted by the UN Environment World Conservation Monitoring Centre (UNEP-WCMC). It aims to enhance coherence in the development and use of indicators and demonstrates where there is consistency in the current use of biodiversity-related indicators in global indicators frameworks. It shows the potential for future synergies, ahead of reviews of SDG indicators and the development of the global post-2020 framework for biodiversity.

The post-2020 global biodiversity framework will be as a stepping stone towards the 2050 Vision of "Living in harmony with nature". The Biodiversity Indicators Partnership and the Secretariat of the Convention on Biological Diversity work closely together to ensure that the BIP is fully integrated into CBD processes, including providing capacity building for indicator development at national level.

The pan-European initiative Streamlining European Biodiversity Indicators (SEBI) was launched in January 2005 to develop appropriate indicators to assess achievement of the biodiversity targets firstly towards 2010 and then towards 2020 at European level. The SEBI initiative is continued towards 2030, after the adoption of the Commission Communication COM(2020) 380 'EU Biodiversity Strategy for 2030: Bringing nature back into our lives'. The ambition of these targets is to put Europe's biodiversity on a path to recovery with benefits for people, the climate and the planet.

Over the last decades, a vast network of nature reserves has been built up, covering nearly 26.000 protected areas in the EU Member States and a total area of more than 850.000 km<sup>2</sup>, representing approximately 18% of total EU terrestrial area. This vast array of sites is known as the Natura 2000 network – the largest coherent network of protected areas in the world.

The legal basis for the Natura 2000 network comes from the Birds Directive, which dates back to 1979, and the Habitats Directive from 1992. Together with the Communication from the Commission Halting the loss of biodiversity by 2010 – and beyond, these Directives constitute the backbone of the EU's internal policy on biodiversity protection.

### V4.1.7.2. SOURCES OF DATA

It is necessary to have maps of designated areas and inventories of all protected areas of the country showing their location, size, date of establishment and protection regime in accordance with national legislation and relevant international requirements. For inter-country comparisons, protected areas could also be grouped by the IUCN categories. Monitoring is done on an annual basis.

The size of the protected area (its "extent") is the officially documented total area provided by the national authority or as listed by the World Database on Protected Areas and may be generated from spatial (GIS) boundary data. In the EU, the Natura 2000 network contains an overview over special protected areas (bird sites, habitat sites and marine environment) according to biogeographical regions (Atlantic, Alpine, Boreal, Continental, Mediterranean and Macaronesian).

IUCN defines six management categories of protected area falling into two groups. Totally protected areas are maintained in a natural state and are closed to extractive uses. Partially protected areas are managed for specific uses (e.g. recreation) or to provide optimal conditions for certain species or communities. This methodology is increasingly used for land ecosystems, less so for marine ecosystems, and least for inland water ecosystems. Inland water ecosystems are usually lumped with land in a terrestrial classification. The methodology for this indicator has not been standardized.

In cooperation with the UNEP World Conservation Monitoring Centre, IUCN's World Commission on Protected Areas compiles the UN List of Protected Areas, which provides the name, IUCN category, location, size and year of establishment of all protected areas meeting the IUCN definition, regardless of size and whether or not they have been assigned an IUCN category for all countries.

The World Database on Protected Areas (WDPA) is compiled from multiple sources and is the most comprehensive global dataset on marine and terrestrial protected areas available. It is a joint project of UNEP-WCMC and the IUCN World Commission on Protected Areas working with governments and collaborating non-governmental organizations (NGOs).

#### To find out more...

##### United Nations and world

- United Nations: [Convention on Biological Diversity \(CBD\)](#)
- [2011-2020 UN Decade on Biodiversity, the Aichi Targets and the Post-2020 Global Biodiversity Framework](#)
- Convention on Biological Diversity (CBD): [Global Biodiversity Outlook \(GBO\)](#)
- Biodiversity Indicators Partnership (BIP)
- United Nations Environment Programme: [World Conservation Monitoring Centre \(UNEP-WCMC\)](#)
- UN Division for Sustainable Development
- UNSD: [Environmental indicators – section 'Biodiversity'](#)
- International Union for Conservation of Nature (IUCN)
- [World Database on Protected Areas \(WDPA\)](#)
- OECD: [Biodiversity](#)

##### European level

- DG Environment: [Nature and Biodiversity, the EU Biodiversity Indicators \(SEBI\), the EU Biodiversity Strategy to 2020 and the Biodiversity strategy for 2030](#)
- DG Environment: [the Natura 2000 network and the Natura 2000 Biogeographical regions](#)
- The Biodiversity Information System for Europe (BISE) web portal and the Streamlining European Biodiversity Indicators (SEBI)
- European Environment Agency (EEA): [European Topic Centre on Biological Diversity \(ETC/BD\) and EUNIS diversity database](#)
- Joint Research Centre (JRC): [Ecosystems and biodiversity](#)
- Eurostat: [Biodiversity statistics \(online article\) and biodiversity datasets](#)
- European legislation: [Birds Directive, Habitats Directive and the European Commission's Communication COM\(2020\) 380 EU Biodiversity Strategy for 2030 - Bringing nature back into our lives](#)
- [Pan-European Common Bird Monitoring Scheme \(PECBMS\)](#)

## V4.1.8. Land cover and land use statistics

### V4.1.8.1. CONCEPTS AND DEFINITIONS

Land Cover/Land Use (LC/LU) information is basic information needed in many statistical fields: in agriculture statistics (covering Utilised Agricultural Area) to provide information on production areas and to estimate agricultural production, in forestry statistics (covering wood production areas) to estimate timber production (with forest inventory data), in urban statistics to calculate population density, in environment statistics to inform agri-environmental indicators, biodiversity, landscape diversity, water quality, soil quality and soil erosion, etc. Further fields of application are spatial planning, urban and rural development, climate change, damage assessment in case of natural or man-made hazards, etc.

LC/LU data is required at various spatial and administrative levels, i.e. local, regional, national and global. Depending on the application, the level of detail of the LC/LU classification varies from rough classifications (e.g. about 10 classes defined by the UNFCCC for reporting on Land down to more than 80 LC/LU types for biotope/habitat mapping (e.g. System for European countries).

#### Land

For land cover, the reference area is above the surface. This is not so obvious for land use, e.g. in view of complex multi-purpose use of buildings (parking areas, shops, offices and apartments on different floors of the same building) or of mine deposits (is the complete underground oil field the reference area or only the dwell?).

Another important aspect is the consideration of inland waters within the "land" definition. Eurostat excludes the inland water from the statistical definition of the "land area" e.g. within the Demography statistics domain, due to the impact of inland water areas on indicators such as population density (e.g. 17% of the territory of the Netherlands is inland water).

In contrast, Eurostat recommends including inland waters and tidal flats in Land Cover/Land Use information. In general, the definition of the reference area ("land") needs to be taken into account when using LC/LU data from multiple different sources. Although the LU/LC methodology has been developed in a European context, it builds on general concepts and approaches. Thus, this methodology and its basic principles may be applied in any developing country. In particular, the issue of inland waters and tidal flats is relevant in many developing countries.

#### Land cover and land use

Most of the existing information on LC/LU is mixing **land cover** and **land use**. Natural and semi-natural vegetation are described in terms of land cover, while agricultural and urban areas are described in terms of land use (see the CORINE Land Cover classification).

However, these are two different issues: distinction between land **cover** and land **use** is fundamental, though often ignored or forgotten. Confusion and ambiguity between these two

terms lead to practical problems, particularly when data from the two different dimensions need to be matched, compared and/or combined. An example of a clear separation in land cover and land use is represented by the LUCAS nomenclature.

The Eurostat "Manual of Concepts on Land Cover and Land Use Information Systems" defines these terms as follows:

- **Land cover** corresponds to a physical description of space, the observed (bio-) physical cover of the earth's surface. This description enables various biophysical categories to be distinguished - basically, areas of vegetation (trees, bushes, fields, lawns), bare soil (even if this is a lack of cover), hard surfaces (rocks, buildings) and wet areas and bodies of water (sheets of water and watercourses, wetlands). Land Cover is "observed", meaning that observation can be made from various "sources of observation" at different distances between the source and the earth's surface.
- **Land Use** corresponds to the description of areas in terms of their socio-economic purpose: areas used for residential, industrial or commercial purposes, for farming or forestry, for recreational or conservation purposes, etc. Links with land cover are possible; it may be possible to infer land use from land cover and conversely. But situations are often complicated and the link is not so evident. Contrary to land cover, land use is difficult to "observe". For example, it is difficult to decide if grasslands are "natural" (or semi-natural), so not used, or if they are used for agricultural purposes. The information coming from the source of the observation may be sufficient, e.g. indications on the presence or absence of cattle, or may require additional information, for example from the land owner or the farmer.

The LUCAS manual has been designed for the European level, but its overall methodology could be applied in any other region/country of the world. The definitions of "land cover" and "land use" may need to be adapted in response to the particular situation in individual countries.

### V4.1.8.2. SOURCES OF DATA

There are two main approaches for collection of land cover / land use data:

1. The mapping approach: land cover/use of the 'Area of Interest' is exhaustively ("wall-to-wall") mapped on the basis of topographic or cadastral maps or aerial photographs or satellite images such as GLOBCOVER (covers countries worldwide, e.g. China, Mexico, Argentina, Democratic Republic of Congo, Burkina Faso and other African countries) and CORINE Land Cover;
2. The statistical (sampling) approach: sample of units are observed and the land cover/use estimated. These units can be selected from a list of administrative or socio-economic entities (list frame surveys) or can be represented by a portion of land – polygons, lines (transect), points (area frame surveys). An example of a list frame survey on LC/LU in EU is the Farm Structure Survey, AGRIT in Italy, ESYRCE in Spain, Countryside Survey in the UK, TerUti in France, Eurostat's Land Use / Cover Area frame statistical Survey - LUCAS are examples of area frame surveys in individual countries in Europe.

Exhaustive mapping of land cover/use is required when spatially explicit information is needed, for example in regional/physical planning or calculation of indicators on spatial patterns of a landscape (e.g. fragmentation). Land use/cover mapping can be time and cost intensive, depending on the size of the area to be covered and the level of detail in terms of land use/cover types and geometry, i.e. the scale of the resulting map.

A detailed biotope mapping of a small natural conservation area is best carried out by field survey, for example by botanists going on the ground and map the areas occupied by specified plant societies in the dedicated area. Such a field survey is time consuming and cost intensive. If there are a number of similar biotopes within a country, surveying a representative statistical sample of such areas allows estimating the areas covered by the same type of biotope at the level of the country.

An additional method to collect spatially explicit LU/LC data is remote sensing. Energy reflected or emitted from the earth's surface is recorded by cameras or digital sensors (CCDs) mounted on airplanes, helicopters, balloons or satellite platforms, recording the energy in a multitude of bands of the electromagnetic spectrum. Satellite images cover large areas with a stable geometry, yielding easier handling of the data for geo-referencing (projecting the image onto map coordinates). Satellites fly regularly over the same area with the same specifications, making data processing a routine task and monitoring of changes much easier. The dependency of optical sensors of the weather is overcome through RADAR sensors, which can "see" through clouds. The geometric resolution of airborne digital images allows a larger mapping scale than space borne data, but the difference in resolution is decreasing. The remote sensing approach requires ground-truth data for calibration.

List and area frame surveys represent a common approach to gather land cover and land use data. In contrast to mapping techniques, they provide quantitative statistical results with precision indicators attached to them. Based on the visual observation of a sample of units, estimates of the extent of land cover/use classes are computed. The list frame surveys are mainly used when the scope of the analysis is a specific domain (i.e. agricultural areas). If the scope is extended to all the dimensions of LC/LU, usually the area frame approach is chosen.

The implementation of an area frame survey can go through different steps. For example, in the case of the LUCAS EU survey, first a hypothetical grid is laid over the EU territory. The grid nodes are super-imposed over aerial photos and satellite images, with the land cover on these points photo-interpreted and pre-classified (stratification phase) with a very broad aggregation. For receiving the necessary detailed classification and avoiding errors due to photo-interpretation, a sample of these points is physically surveyed on the ground. The results, which the surveyors report to the office, are combined with the outcomes of the stratification, for calculating area estimates on the land cover and land use classes all over Europe.

The Eurostat "Manual of Concepts on Land Cover and Land Use Information Systems" is a reference for further reading on land information methodologies, data collection approaches and survey methods.

### Box V4.1.9: Examples of Land Information Systems

GlobCover was an ESA initiative in partnership with JRC, EEA, FAO, UNEP, GFOC-GOLD and IGBP. The GlobCover project developed a service capable of delivering global composite and land cover maps, using as input observations from the ENVISAT satellite mission. GlobCover provided satellite data and land cover products at global and regional level according to the FAO "Land Cover Classification System (LCCS)".

The US Geological Survey (USGS), together with the US National Aeronautics and Space Administration (NASA), provides global coverage of digital satellite images from the US Landsat satellites. Based on this data, historic monitoring of land cover/use can be carried out.

The Environmental Data Explorer is the authoritative source for data used by the UNEP Global Environment Outlook (GEO) and other integrated environment assessments. Its online database holds more than 500 different variables, as national, sub-regional, regional and global statistics or as geospatial data sets (maps), covering themes like Freshwater, Population, Forests, Emissions, Climate, Disasters, Health and GDP.

The Africover Project established a digital geo-referenced database on land cover and a geographic referential for the whole of Africa, including geodetical homogeneous referential, toponomy, roads and hydrography, in the Multipurpose Africover Database for the Environmental Resources (MADE). The core strategy of Africover was to reinforce national and sub-regional capacities for establishing, updating and using geographic referential and land cover maps and spatial data bases. This methodology has been adopted to ensure an operational approach and the sustainability of the initiative. Africover was the basis for the establishment of the Global Land Cover Network (GLCN).

The European Environment Agency coordinates the CORINE Land Cover project, covering about 32 European countries. The data is photo-interpreted on the base of satellite imagery. There are currently 3 data sets available (1990, 2000 and 2006).

Eurostat collects information via its Land Use / Cover Area frame statistical Survey - LUCAS. LUCAS is a field survey, carried out on sample points spread over the entire territory of the Member States. Data on land cover and land use is collected and landscape photographs are taken, enabling detection of changes in LC/LU and in European landscapes. There are currently 2 datasets available (2006, 2009).

### To find out more...

- European Environment Agency: [CORINE Land Cover; CORINE Land Cover classification, Data and maps](#)
- Eurostat: [LUCAS website](#), [Manual of Concepts on Land Cover and Land Use Information Systems](#) and the [Land Use / Cover Area frame statistical Survey \(LUCAS\)](#)
- Eurostat: [statistical definition of the "land area"](#)
- Eurostat – Statistics Explained: [LUCAS - Land use and land cover survey](#)
- Food and Agriculture Organization (FAO): [Land Cover Classification System \(LCCS\)](#), [Global Land Cover Network \(GLCN\)](#) and [Africover](#)
- European Space Agency (ESA): [GlobCover Portal](#)
- U.S. Geological Survey (USGS)
- UNEP Global Environment Outlook (GEO): [Environmental Data Explorer](#)
- Examples of area frame surveys: [Farm Structure Survey](#), [AGRIT](#), [ESYRCE](#), [TerUti](#)

### V4.1.9. Analysing data quality and identifying problems

The environment is a horizontal issue in the sense that all human activities are concerned to some extent. Developing environmental indicators thus requires information related to a wide range of activity sectors.

Like all indicators, the quality of environmental indicators and statistics relies on the quality of data and statistics used as input. Generally, more than one institution or body is involved in gathering data and information necessary to establish environmental indicators; each of them is responsible for compiling information on specific activities, potential emission sources, monitoring environmental parameters etc. All these institutions, at all levels from local to national, have or should follow harmonised procedures to ensure quality and inter-comparability of the data they are collecting as well as of the statistics they are producing.

Good quality and reliable indicators should meet some basic and inter-related criteria:

- **Reliability of sampling and measurement:** sampling and measurement should follow standardised international procedures like ISO/CEN standards. It is an asset to use certified and trained personnel for sampling, especially when samples for laboratory analysis are being obtained. Ideally there should be one reference laboratory at the national level accredited ISO 14025, the main standard used by testing and calibration laboratories.
- **Representativeness and completeness:** the indicator integrates all input data needed in terms of e.g. spatial and time coverage. (For example, emission inventories will cover all SNAP sectors.) Collecting adequate and precise information on the sampling/monitoring location is therefore of utmost importance in order to evaluate results.
- **Consistency and coherence:** the environmental indicator should be meaningful and should not be in contradiction with other related indicators or statistics. For example, the water losses indicator should be consistent with those on a freshwater abstraction and on water usage, and the ambient air concentration for one pollutant should be consistent with the corresponding emission indicator.

- **Comparability:** this is ensured by using similar and harmonised definitions and methodologies at the national level but also in line with international standards in order to allow comparison between countries. The use of standardized methods as far as feasible (depending on costs and complexity) ensures not only data quality as explained above, but also comparability of results both within a country and internationally. For example, national definitions of hazardous waste may change over time, as national legislation is revised. Therefore, the definition of hazardous waste varies greatly from one country to another, and sometimes also over time.
- **Traceability:** reliable and full documentation is of utmost importance when updating or repeating an exercise, e.g. for another year in order to allow trend analysis. Lacking traceability and documentation may limit data quality and comparability.

To this end, quality control procedures covering the different aspects related to these different criteria should be developed and implemented at the different levels of the data chain, from sampling and data acquisition to the final compilation. Cross-checking, expert judgment and quantification of uncertainties are important tools in order to evaluate fulfilment of the above criteria but also to identify possible data and knowledge gaps.

This is illustrated in Box V4.1.8 where data quality requirements for the European Air Quality monitoring network (EuroAirnet) are defined. In Box V4.1.9, uncertainties associated to emission inventories are presented. This example concerns the emissions of greenhouse gases, but this also applies to the emission inventories described in section V4.1.2.

**Box V4.1.10: Data quality requirements for EUROAIRNET**

**Precision.** The closeness of agreement between independent test results obtained under stipulated test conditions.

**Notes:**

- Precision depends only on the distribution of random errors and does not relate to the true value or the specified value.
- The measure of precision is usually expressed in terms of imprecision and computed as a standard deviation of the test results. Less precision is reflected by a large standard deviation.
- “Independent test results” means results obtained in a matter not influenced by a previous result on the same or similar test object. Quantitative measures of precision depend critically on the stipulated conditions.
- Repeatability and reproducibility conditions are particular sets of extreme conditions (ISO 5725-1, 1994).
- Repeatability: Precision under repeatability conditions (ISO 5725-1, 1994).
- Repeatability conditions: Conditions where independent test results are obtained with the same method on identical test items in the same laboratory, by the same operator, using the same equipment within short intervals of time (ISO 5725-1, 1994).
- Reproducibility: Precision under reproducibility conditions (ISO 5725-1, 1994).
- Reproducibility conditions: Conditions where independent test results are obtained with the same method on identical test items in different laboratories, with different operators, using different equipment (ISO 5725-1, 1994).

**Accuracy.** The closeness of agreement between a (one) test result and an accepted reference value.

**Note:**

The term accuracy, when applied to a set of test results, involves a combination of random components and a common systematic error or bias component (ISO 5725-1, 1994).

**Correctness.** The closeness of agreement between the average value obtained from a large series of test results and an accepted reference value.

**Notes:**

The measure of correctness is usually expressed in terms of bias. It was referred to as “accuracy of the mean” which is not recommended (ISO 5725-1, 1994).

**Representativeness.** This parameter expresses the degree to which the air pollution measurement data are adequately representative, both of the location in which monitoring is taking place, and of the time period to be covered. The location (spatial) part can be quantified by the area of representativeness: the area in which the concentration does not differ from the concentration measured at the station by more than a specified amount. The temporal part is covered by the data capture and time coverage indicators below.

**Data capture.** The percentage of measurements made which are judged to be valid measurements.

**Time coverage.** The percentage of time covered by the operational time of the measuring device.

**Comparability.** This is a qualitative parameter expressing the confidence with which one set of air pollution measurement data can be compared with another. Data representative of air pollution levels of a location should be possible to compare with measurement data of another similar location. It should be noticed that data of known precision and accuracy and with a high degree of representativeness and completeness can be compared with confidence.

Source: [Criteria for EUROAIRNET - The EEA Air Quality Monitoring and Information Network](#)

**Box V4.1.11: Identifying uncertainties in emission inventories**

In inventories of emissions, it is important to consider the estimated uncertainty of emissions from individual sources (e.g. power plants, motor vehicles, dairy cattle). This may depend on the way emission data are measured; how data are fitted with other information and how often measurement is carried out. More often, the uncertainty comes from a combination of the uncertainties in the factors affecting the emissions from a source and the activity of that source (e.g. the production at a power plant, the kilometres driven by motor vehicles). The uncertainties in the emission factors and in the data on activity should be described using so-called 'probability density functions'. A detailed overview of this issue which is also applicable in developing countries is given in 'Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories' published by the IPCC Task Force on this topic.

Uncertainties affecting emission inventories may be associated with:

- Continuous monitoring of emissions, which is usually consistent with good practice for the specific type of emission source.
- Direct determination of emission factors. In some cases, emission measurements may be available at a site. If these measurements can be linked to activity data, it is possible to determine a site-specific emission factor. This can be a complex task, as emissions may be dependent on e.g. start-up and shut-down as well as load.
- Emission factors from published references. When site-specific data are unavailable, good practice will usually be to use emission factors drawn from scientific literature. However, there are uncertainties both associated with the original measurements and whether these fit to the actual site.
- Activity data, which are closely linked to economic activity and are normally well defined, e.g. through tax and accounting rules. Activity data therefore tend to have lower uncertainties. Activity data are usually collected regularly by NSIs.
- Expert judgement, which should be used when empirical data are lacking.

Source: IPCC Task Force: [Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories](#)

**V4.1.10. Improving sector statistics**

As mentioned earlier, more than one institution is possibly involved throughout the monitoring and in generating indicators. In many countries, however, there is no or not a fully developed structure to manage environmental information. A first step would then be to set up a structure responsible for collating and compiling environmental information.

The structure must comprise for each environmental sector (air, water, waste ...) all institutions or bodies in charge of:

- generating the necessary information and data (including those carrying out monitoring of environmental parameters);
- collating and compiling information and data.

The responsibilities must be clearly identified in terms of area(s) of competence (including international commitments) and duties. These bodies may not have experience in working together and/or authority of sharing information. So coordination and connection channels will be established if necessary in order to ensure effective data and information sharing. This may require the development of memoranda of understanding and even in some cases the amendment of legal instruments ruling the functioning of public services.

**Box V4.1.12: European Commission: Environmental Integration Handbook for European Commission Development Co-operation**

The European Commission's "Environmental Integration Handbook for EC Development Co-operation" provides an introduction to the rationale and concepts for environmental integration. It outlines an operational framework covering the three main aid delivery modalities. To enhance the efficiency of development activities, it is crucial to consider environmental issues already in preparation of the Country Strategy Paper (CSP), and the National Indicative Programme (NIP) also has to address this topic.

In order to adequately inform this process, the key tool is the Country Environmental Profile (CEP). The CEP is a report that contains a description and broad assessment of a country's environmental situation, policy and regulatory framework, institutional capacities and environmental co-operation. The CEP is primarily meant to facilitate the integration of the environmental dimension in the country analysis, response strategies and multi-annual programming. The CEP should also be used to underpin policy dialogue.

The Handbook provides an example of Terms of Reference for developing a CEP (Annex 2). However, whereas the Handbook defines the key areas that should be covered by the CEP, it does not define specific indicators. In this process, existing indicators and methodologies should be applied as far as possible. The EEA sets of environmental indicators, presented in Box V4.1.14, could be used as reference and basis.

Source: European Commission: [Environmental Integration Handbook for EC Development Co-operation](#)

Another critical issue is to identify the indicators which need to be generated. There are hundreds of environmental indicators in use across the world. In practice it is not realistic or even necessary to generate all of them. The competent authorities must decide on priority indicators, taking into account:

- the national geographical context;
- main environmental issues at stake in the country;
- data and information readily available and those that are envisaged for the near future;
- available human and financial resources and constraints.

A comprehensive set of environmental indicators that can be used as a reference are the indicators maintained by the EEA. These indicators are grouped by theme/sector, and are designed to inform key policy questions and support

all phases of environment policy making. They support the design of policy frameworks and guide the setting of targets, they are used for monitoring and evaluation of environment policies and for communicating on priorities, progress and results. The EEA's Core Set of Indicators (CSI) comprises key indicators, drawn from the dedicated indicator sets for specific topics: (Climate state and impact indicators (CLIM); Air indicators (AIR); Waste indicators (WST); (Water indicators (WAT); Water resource efficiency indicators (WREI); Marine indicators (MAR); Streamlining European biodiversity indicators (SEBI); Land and soil indicators (LSI); Transport and environment reporting mechanism (TERM); Energy indicators (ENER), and; Industrial Pollution indicators (INDP). These indicator sets maintained by the EEA are detailed in Box V4.1.14.

### **Box V4.1.13: Environmental accounting**

The environment has an important impact on every economy and has to be considered in the context of globalisation. Environmental accounting is an indispensable tool to measure the role played by the natural environment in the economy. It should highlight both the contribution of natural resources to economic well-being and the costs of pollution and resource degradation. Environmental accounts are designed as "satellite accounts" to accompany the System of National Accounts (SNA). However, they show results in monetary terms only in a few cases. In general, environmental accounts are divided into the following sections:

- Economic environmental accounts;
- Physical environmental accounts;
- Environmental asset accounts;
- Production and consumption structures.

At EU level, environmental accounting has been endorsed into the Statistical Programme in 2003 and has its legal basis in Regulation (EU) No 691/2011 on European environmental economic accounts. An expansion of environmental accounts statistics with high quality, reliability and timeliness is also embedded in the European Strategy for Environmental Accounts 2019-2023.

Methodologies for all sections mentioned above need to be developed. Eurostat has data on environmental accounts, which are divided into "monetary flow accounts" and "physical flow and hybrid accounts". Both datasets are still being improved and enhanced. Data availability is slowly improving. Although environmental accounts provide a wealth of detailed statistics, data availability is not yet sufficient to deliver headline indicators. Beside the already existing indicators, Eurostat, the European Environment Agency, the OECD, the WWF and the Club of Rome are involved in additional environmental accounting projects on land cover accounts, ecosystem capital accounts, water accounts as well as sustainable consumption and production analysis.

Methods on environmental accounting statistics are not yet agreed internationally or are still under development. However, due to the strong links between the environment and the economy in many developing countries, they should keep the data needed for environmental accounts in mind when designing their statistical strategies.

A condition for the collection of these statistics is a sound methodology for the collection of national accounts data and the availability of the main datasets for national accounts. Based on these data, developing countries may follow the European Union's approach and prepare data for the indicators which can be derived from the national accounts system. These are environmental (protection) expenditure and investment by the public and by economic sectors, as well as environmental tax revenues.

Some developing countries, for example Chile, Ecuador, India, the Philippines, Botswana, Namibia, South Africa and Zimbabwe have already some experience in environmental accounting. Information on the work and results achieved by these and further developing countries is provided by the United Nations Statistics Division.

### Box V4.1.14: EEA indicator sets

#### CSI (Core Set of Indicators)

- Abundance and distribution of selected European species
- Use of freshwater resources in Europe
- Share of renewable energy in gross final energy consumption in Europe
- Energy intensity in Europe
- Passenger and freight transport demand in Europe
- Landscape fragmentation pressure and trends in Europe
- Land take in Europe
- Waste recycling
- Waste generation in Europe
- Exposure of Europe's population to environmental noise
- Hazardous substances in marine organisms
- Industrial pollution in Europe
- Emissions of the main air pollutants in Europe
- Chlorophyll in transitional, coastal and marine waters
- Nutrients in transitional, coastal and marine waters
- Fishing fleet pressure
- Status of marine fish stocks
- Nationally designated protected areas

#### CLIM (Climate state and impact indicators)

- Meteorological and hydrological droughts in Europe
- River floods
- Forest fires
- Heavy precipitation in Europe
- Heating and cooling degree days
- Mean precipitation
- Hail
- Wind storms
- Water- and food-borne diseases
- Water-limited crop yields
- Agrophology
- Crop water demand
- Growing season for agricultural crops
- Extreme temperatures and health
- Floods and health
- Vector-borne diseases
- Forest composition and distribution
- Phenology of plant and animal species
- Distribution shifts of plants and animal species
- Water temperature
- River flow
- Distribution shifts of marine species
- Ocean heat contents
- Glaciers
- Snow cover
- Air pollution due to ozone: health impacts and effects of climate change

#### AIR

- Heavy metal emissions
- Persistent organic pollutant emissions
- Emissions of the main air pollutants in Europe

#### WST (Waste indicators)

- Diversion of waste from landfill
- Waste recycling
- Waste generation in Europe

#### WAT (Water indicators)

- Use of freshwater resources in Europe
- Water intensity of crop production in Europe

#### WREI (Water resource efficiency indicators)

- Use of freshwater resources in Europe

#### MAR (Marine indicators)

- Changes in fish distribution in European seas
- Pathways of introduction of marine non-indigenous species to

#### European seas

- Hazardous substances in marine organisms
- Chlorophyll in transitional, coastal and marine waters
- Nutrients in transitional, coastal and marine waters
- Aquaculture production in Europe
- Marine protected areas in Europe's seas
- Fishing fleet pressure
- Status of marine fish stocks

#### SEBI (Streamlining European biodiversity indicators)

- Natura 2000 sites designated under the EU Habitats and Birds Directives
- Abundance and distribution of selected European species
- Ecological footprint of European countries
- Public awareness of biodiversity in Europe
- Agriculture: nitrogen balance
- Ecosystem coverage
- Forest: growing stock, increment and fellings
- Freshwater quality
- Forest: deadwood
- Nationally designated protected areas
- Agriculture: area under management practices potentially supporting biodiversity
- Red List index for European species
- Nutrients in transitional, coastal and marine waters
- Livestock genetic diversity
- Invasive alien species in Europe
- Impact of climate change on bird populations
- Financing biodiversity management
- Critical load exceedance for nitrogen
- Aquaculture: effluent water quality from finfish farms

#### LSI (Land and soil indicators)

- Imperviousness and imperviousness change in Europe
- Landscape fragmentation pressure and trends in Europe
- Land take in Europe
- Soil moisture
- Progress in management of contaminated sites
- Soil organic carbon

#### TERM (Transport and environment reporting mechanism)

- Passenger and freight transport demand in Europe
- Final energy consumption in Europe by mode of transport
- Exceedances of air quality limit values due to traffic
- Emissions of air pollutants from transport
- Size of the vehicle fleet in Europe
- Transport fuel prices and taxes in Europe
- Real change in transport prices by mode
- Exposure of Europe's population to environmental noise
- Investment in transport infrastructure
- ENER (Energy indicators)
- Primary energy consumption by fuel in Europe
- Share of renewable energy in gross final energy consumption in Europe
- Energy intensity in Europe
- Intensity of final energy consumption in Europe
- Progress on energy efficiency in Europe
- Efficiency of conventional thermal electricity and heat production in Europe
- Final energy consumption by sector and fuel

#### INDP (Industrial Pollution indicators)

- Emissions of air pollutants from large combustion plants in Europe
- Large combustion plants operating in Europe
- Industrial pollution in Europe
- Industrial waste in Europe

Source: [European Energy Agency \(EEA\) website](#)

**To find out more...****about environmental accounting**

- Regulation (EU) No 691/2011 on European environmental economic accounts
- Eurostat: [Environmental Accounts website](#), [Environmental accounts background article](#) and [European Strategy for Environmental Accounts 2019-2023](#)
- European Environment Agency (EEA): [An experimental framework for ecosystem capital accounting in Europe](#)
- International Union for Conservation of Nature (IUCN) - [scientific background and information on country approaches](#)
- United Nations: [System of Environmental-Economic Accounting \(SEEA\) – Central Framework \(2012\)](#)
- United Nations Statistics Division (UNSD): [Environment statistics](#)
- [London Group on Environmental Accounting](#)
- [“Beyond GDP”](#)

**To find out more...****European Commission**

- DG International Partnerships: [Environmental Integration Handbook for EC Development Co-operation](#)
- European Environment Agency (EEA): [EEA Indicators](#) and [‘Environmental indicators: Typology and overview’](#)
- European Environment Information and Observation Network (EIONET)
- Eurostat: [Environment statistics and environmental accounts](#) and [Sustainable Development Goals \(SDG\) indicators](#)
- DG Environment

**United Nations**

- United Nations Economic Commission for Europe (UNECE): [Environmental monitoring and assessment](#), [environmental indicators](#), [‘Environment for Europe’ process](#) and [‘Online Guidelines for the Application of Environmental Indicators’](#)
- UN Division for Sustainable Development and Sustainable Development Knowledge Platform
- UN Statistics Division (UNSD): [Environmental indicators](#) and [the Sustainable Development Goals indicators database](#)
- United Nations Environment Programme (UNEP)
- World Health Organization (WHO): [Environment and health information system \(ENHIS\)](#)

**Other sources**

- Organisation for Economic Co-operation and Development (OECD): [Environment](#), [Environment statistics](#) and [‘Environment at a Glance’](#)
- [Convention on Biological Diversity \(CBD\)](#)



# V4.2

## Energy statistics





## V4.2. Energy statistics

### *The chapter in brief*

Global energy consumption has grown tremendously over the past decades and is expected to keep increasing considerably, as the demand in developing countries ramps up. Meanwhile, the undesirable side-effects of energy consumption on the health of populations and on the environment emphasize the need for a precise monitoring of energy use.

This chapter covers a wide area of national energy statistics and a variety of energy products, including fossil fuels and renewable energy sources. It lists several applications of energy statistics, such as policy making, as well as international reporting obligations and the various stakeholders involved at the national, regional and global level. It also provides an overview of the internationally agreed methodology. Various potential sources for data at the national level are presented, as well as specific guidance for data collection issued by international organisations. The chapter also includes a quick summary of the main aspects to consider in the quality assessment process, and concludes with some recommendations on how to build or improve energy statistics collection and dissemination in developing countries.

### V4.2.1. Policy applications: what energy data is used for

With an ever-growing global demand for energy, governments, NGOs and many other stakeholders are in need of accurate monitoring of energy supply, trade, storage, transformation and consumption.

Energy is at the centre of economic development, because of its potential application and because of the associated investment requirements.

- In its primary form, such as fuelwood, energy can provide access to the most basic needs such as cooking food and providing heating, hot water and lighting.
- In its more advanced forms, such as electricity or refined fuels, energy can provide access to the same primary needs in a more convenient way, and is also required to access other services such as preserving food, cooling buildings, enabling information and communication, education, health services, entertainment, and physical transport of goods and people within and between countries.
- Finally, thanks to its capacity to provide heat and to power machinery, energy is required in all economic sectors, including the manufacturing industry, construction, agriculture, etc.
- Providing energy in a useful form to populations and to different sectors requires large investments in the infrastructure needed to extract, transform and distribute it.

Energy is also related to a range of negative impacts on people and on the environment.

- The combustion of fuels is known to cause health issues, due to local pollution, such as release of toxic substances, emissions of micro-particles, etc. The World Health

Organization (WHO) estimates that 7 million people die each year from exposure to polluted air. Many of these mortalities (3.8 million in 2016) are attributable to household air pollution from cooking with polluting fuels and technologies. This represents more deaths per year than from car accidents.

- Energy also entails social issues linked to cost and access. For instance, in the rural populations of developing countries, the time spent on gathering fuelwood is often allocated to women and children.
- There are also wider economic concerns regarding the availability of energy at the global level, the rights to extract it, the remaining reserves, the volatility of the market prices, conflicts linked to the access to energy sources and the dependency of some nations on external sources of energy supply.
- Some international organisations are requiring their member states to hold a certain amount of oil stocks in order to ensure supply security in case of disruption. In accordance with the Agreement on an International Energy Programme (IEP), all of the IEA member countries have an obligation to hold emergency oil stocks equivalent to at least 90 days of net imports of the previous calendar year. This covers all petroleum, including both primary and refined products. In case of a severe oil supply disruption, IEA members may decide to release these stocks to the market as part of a collective action.
- Similarly, under the oil stocks directive (2009/119/EC), EU countries must maintain emergency stocks of crude oil and/or petroleum products equal to at least 90 days of net imports or 61 days of consumption, whichever is higher. During a supply crisis, the Commission is responsible for organising a consultation between EU countries and deciding on the course of collective actions.
- Last but not least, environmental concerns associated with energy have been at the basis of international discussions for the last few decades. Human emissions of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases (GHG) are a primary driver of climate change. According to the Joint Research Centre (JRC) in 2019, 36 % of global CO<sub>2</sub> emissions were related to the power industry, and 22 % to other industrial combustion. Another 22 % of the CO<sub>2</sub> emissions originated from the transport sector, while buildings and other sectors (including agriculture) represented 9 % and 11 % respectively.

To address these issues, precise monitoring of energy extraction, trade, transformation and final consumption is necessary. Developing and improving energy statistics, either through regional organisations or national administrations, requires the implementation of the relevant international standards and methodologies.

- Complete energy statistics allows the preparation of energy balances. An energy balance is an accounting framework for the compilation and reconciliation of data on all energy

products entering, exiting and used within the national territory of a given country during a reference period.

- An exhaustive and accurate picture of the energy situation in a region or individual country is required to plan and monitor projects and policies. For instance, energy models can only provide useful information on the future consequences of today's decisions if the base data accurately represent the current energy system.
- Moreover, energy balances are the basis for further data work, including the calculation of energy efficiency indicators and GHG emissions estimates. On top of their informative value for the regional organisations and national administrations, these figures are used to track progress toward the Sustainable Development Goals (see Box V4.2.1).
- In particular, the internationally agreed methodologies and definitions for energy statistics are aligned with the GHG inventories guidelines from the International Panel on Climate Change (IPCC), so that for example default emissions factors for each product can be applied to the energy data collected.
- Several international and regional organisations are collecting national energy statistics from their member countries, including the European Union (EU), the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the African Energy Commission (AFREC), the Organization of the Petroleum Exporting Countries (OPEC), the United Nations (UN), the Latin American Energy Organization (OLADE), the Asia-Pacific Economic Cooperation (APEC) and others.
- Dedicated international platforms have also been created for countries and organisations to collaborate on the topic of data collection methodology and transparency.
- The Oslo Group was created by the UN Statistical Commission to contribute to improved international standards and methods for official energy statistics. It was established in 2005, and members include energy statisticians from national statistical offices, from energy ministries and from international organisations, as well as experts from academia and the private sector.
- The Intersecretariat Working Group on Energy Statistics (InterEnerStat) aims at enhancing coordination and collaboration to improve the availability and quality of international energy statistics, without increasing the response burden on countries and by making best use of resources.
- The International Energy Forum (IEF) gathers six international Organisations (APEC, Eurostat, OLADE, OPEC and the UN), who have agreed to share data in a transparent and timely manner. The initiative was founded in 2002 and, and although it initially targeted only oil market information, natural gas data was added to the initiative in 2013. Aside from gathering data from the different organisations and disseminating it on the Joint Organisation Data Initiative (JODI) World database, the IEF also organises training programmes for data providers at

national administrations and in energy companies who collect and submit the data.

Preparing energy data in line with the reporting obligations of the various stakeholders has required nations to put in place specific arrangements within their administrations, often including both the energy ministry and the national statistical office.

## Box V4.2.1: Energy in the African Union's Agenda 2063

Point 72 of the declaration of the African Union's agenda 2063 is specifically referring to Energy:

*"We hereby adopt Agenda 2063, as a collective vision and roadmap for the next fifty years and therefore commit to speed-up actions to [...] connect Africa through world-class Infrastructure, including interconnectivity between island states and the mainland, and with a concerted push to finance and implement the major infrastructure projects in [...] harnessing all African energy resources to ensure modern, efficient, reliable, cost-effective, renewable and environmentally friendly energy to all African households, businesses, industries and institutions, through building the national and regional energy pools and grids, and PIDA (Program for infrastructure development in Africa) energy projects."*

## V4.2.2. Concepts and definitions in energy statistics

The United Nations Statistics Division (UNSD), together with Eurostat, international organisations and representatives from different countries developed the International Recommendations for Energy Statistics (IRES)<sup>55</sup>, which provide the methodological framework for the collection, compilation and dissemination of energy statistics.

The first milestone in the development of IRES was the adoption of the Standard International Energy Product Classification (SIEC), which is the first standard classification for energy products. It provides a set of internationally harmonised definitions for energy products and links to other internationally agreed product classifications, such as the Central Product Classification (CPC), the International Standard Industrial Classification of All Economic Activities (ISIC) and the Harmonized Commodity Description and Coding System (HS).

IRES also provides a set of internationally agreed recommendations covering all aspects of the statistical production process, from the institutional and legal framework, basic concepts, definitions and classifications to data sources, data compilation strategies, energy balances, data quality issues and statistical dissemination.

The target audience of IRES comprises compilers of national statistics, policymakers, international and regional

<sup>(55)</sup> IRES was prepared by UNSD in close cooperation with the Oslo Group on Energy Statistics and the Intersecretariat Working Group on Energy Statistics (InterEnerStat). Consultations with specific groups of experts took place during the preparation process, such as the Committee of Experts on Environmental-Economic Accounting, the Expert Group on International Economic and Social Classifications and the London Group on Environmental Accounting.

organisations dealing with energy-related issues, research institutions and energy analysts, and the general public.

Following the adoption of IRES, the IEA and Eurostat has together developed the 'Energy statistics manual', which provides all definitions and best practices for proper energy statistics reporting.

Additionally, the IEA has developed the 'Energy efficiency indicators: fundamentals on statistics' manual for statisticians, which covers all the different practices to collect and a methodology to report energy end-use and activity data to calculate energy efficiency indicators.

Energy data is often collected in the format of a commodity balance, which records the main steps that an energy commodity will go through between its extraction and its final use. The commodity quantities are measured in the same units across the entire chain. These steps include:

- Production of energy commodities: for example, extraction of primary fossil fuel, generation of primary electricity, heat from renewable or nuclear sources.
- Trade: international imports and exports of energy commodities. Note that fuel used in international marine bunkers and international civil aviation are reported separately. The main reason for that is that, following the United Nations Framework Convention for Climate Change (UNFCCC) guidelines, emissions associated with this consumption are excluded from national inventories and added as a separate element in the world total.
- Stock changes: difference in the level of stocks of the energy products between the start and the end of the reporting period.
- Transformation: conversion (physical and/or chemical) of an energy commodity from its primary form into a secondary form that is useful for its intended application. This includes, among others, crude oil refining and coal combustion for electricity and heat.
- Final consumption: records the consumption of energy commodities in all sectors of the economy. This use can be for energy purposes (e.g. heat, operation of machinery through fuel or electricity) or non-energy use (e.g. lubricants, steel processing)

Aside from the commodity balances, some other information is often collected, such as:

- Electricity generation capacity
- Refinery capacity
- Stock levels at the start and at the end of the period

### **Box V4.2.2: Data collections for energy statistics in the EU**

Main legal acts on energy statistics:

- Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics
- Regulation (EC) No 223/2009 of the European Parliament and of the Council of 11 March 2009 on European statistics
- Regulation (EU) 2016/1952 of the European Parliament and of the Council of 26 October 2016 on European statistics on natural gas and electricity prices

Data collection (several questionnaires are joint IEA/UNECE/Eurostat questionnaires)

- Annual questionnaires:
  - six questionnaires: electricity and heat; natural gas; oil and petroleum products; solid fuels (coal); renewables and wastes; nuclear.
  - moreover, Eurostat collects annual data via other questionnaires: disaggregated final energy consumption in households, disaggregated final energy consumption in industry, combined heat and power generation, district heating and district cooling.
  - additional data collections are being developed (e.g. disaggregated energy consumption in services and for transport activities, biomass).
- Monthly questionnaires: oil and petroleum products; natural gas; electricity; coal.
- Half-yearly questionnaires: energy prices (electricity and natural gas), broken down by households / non households.

Details on these questionnaires and data collections can be found on Eurostat's website in the dedicated section on Energy statistics, in the sub-section on Methodology.

## V4.2.3. Sources of energy data and metadata

At the national level, energy statistics are collected from various sources:

- Supply information is available from energy producers, regulators, and other energy industry actors (e.g. refineries, transmission and distribution operators).
- Trade amounts can be obtained from customs offices and trade associations.
- Energy use can be obtained from the different consumers, mainly industries and households

These statistics are collected via different types of data collection:

- Surveys are used to collect data from enterprises (consumption and sales data) and households (end use

surveys). They can be either dedicated to the energy topic (see Box V4.2.3) or a module can be added as part of the general household survey (see Box V4.2.4)

- Administrative data can be gathered from energy regulators, customs offices, tax offices, ministries (e.g. for data collected from programme/policy implementation) and industry and trade associations, chamber of commerce, vehicle registration authority (see Box V4.2.5), etc.
- Direct measurements are also possible for e.g. for electricity via conventional and smart meters or sub-meters (on appliances) in the industry, and in public, commercial and residential buildings.
- When data collection is not possible, estimation or modelling can be used, for example in order to infer photovoltaic electricity generation based on the installed capacity (see Box V4.2.6), or to project the consumption based on economic models.

### Box V4.2.3: IRENA biogas survey

In recent years, many governments have launched national biogas programmes, aiming to promote and facilitate the use of household digesters in order to produce biogas to be used for cooking and lighting. Ensuring an accurate accounting of the use of biogas is vital to monitor the projects and policies, to assess the environmental impact and to track progress towards the sustainability targets.

IRENA has published the field guide 'Measuring small-scale biogas capacity and production', which presents various methodologies for estimating biogas capacity, production and consumption. The material proposed can be integrated into national censuses, household surveys and energy surveys.

Different methodologies are presented for estimating biogas production, based on either direct measurement, plant capacity, appliance use, feedstock use or by comparing fuel use in households with and without a biogas plant (the fuel substitution method). The advantages and disadvantages of each method are also compared. For each of these methods, the data collection required is described, as well as the calculation methodology. The resulting production figures can then be used to assess the impact of the biogas use, such as reduction in fossil fuel consumption and GHG emissions.

#### Plant capacity:

1. Have you used your biogas plant in the last year (Yes/No)?
2. What is the main type of waste that this plant is designed to use (cattle/poultry)?
3. How much gas is the plant designed to produce each day (m<sup>3</sup>/day)?
4. Indicate the type of biogas plant that is being measured:
  - o Fixed dome plant (hemisphere)
  - o Fixed dome plant (Deenbandhu)
  - o Fixed dome plant (Chinese design)
  - o Floating drum plant
  - o Balloon/bag digester
  - o Non-standard design (go to Q3)
5. Write in the dimensions of the biogas plant (cm):
  - o Diameter
  - o Digester height (floating drum)
  - o Gas holder height (floating drum)
  - o Length (balloon/bag digester)
6. If non-standard design, sketch the plant and show the main dimensions

The guidance also indicates how data collectors can measure these dimensions in the field and how they can be used to calculate plant volume for each of the main types of biogas digester.

#### Appliance use

1. Do you use any biogas lamps (Yes/No)? (tick one)
2. What is the average power rating of each lamp (l/hour or Watts)?
3. On average, how many hours per day do you use each lamp (hrs/day)?
4. What is the power rating of each burner on your biogas stove (l/hour or Watts)?
5. On average, how many hours per day do you use each burner for cooking and boiling water (hrs/day)?
6. Do you also burn excess biogas (Yes/No)?
7. On average, how many hours per day do you use each burner to burn excess biogas (hrs/day)?

Examples of appliance power ratings are given in order to calculate the annual biogas consumption of households.

### Feedstock use

1. Do you feed the digester with waste from any of the following animals (number)?
  - o Buffalo
  - o Cows
  - o Calves
  - o Sheep/goats
  - o Pigs
  - o Hens
  - o Horses
  - o Humans
2. How much of the following types of waste do you usually add to the digester each day (kg/day)?
  - o Cereals/grains
  - o Rice straw
  - o Wheat straw
  - o Grass
  - o Corn stalk
  - o Fruit waste
  - o Vegetable waste
  - o Fats
  - o Mixed food waste
  - o Mixed organic waste
3. When you feed the digester, how much water do you add compared to the amount of waste?
  - o Half as much water
  - o An equal amount of water
  - o Twice as much water
  - o Three times as much water
  - o Over three times as much water

The average feedstock properties of animal and vegetal wastes are provided, in order to estimate the resulting biogas production.

### Fuel use

How much of the following types of fuel do you use for cooking each day (kg/day or litres/day)?

- o Fuelwood
- o Charcoal
- o Kerosene
- o Bottled gas (LPG)

The standard energy contents for the replaced fuels are provided, which allow to estimate the equivalent volume of biogas used.

Finally, questions regarding information on the financial and technical performance of the biogas plant are proposed, which allow assessing the effects of the technology penetration in terms of energy access and socioeconomic impacts.

This field guide can be completed with another publication, gathering the 'Lessons learned in six countries: testing IRENA's biogas survey guidelines'.

### Box V4.2.4: FAO Woodfuel Supplementary Module

Woodfuel still plays a critical role for cooking in many developing countries, but it also has negative impacts on the health of the population and on the environment. This explains the need for reliable data for estimating the patterns and trends of woodfuel consumption and production, which is often lacking in the countries concerned. Because of this, wood energy is commonly neglected in national policies.

Because conducting surveys specifically on energy consumption is often not an affordable option for developing countries, FAO has published the 'Guidelines for the incorporation of a woodfuel supplementary module into existing household surveys in developing countries' for the Woodfuel Supplementary Module (WSM) tool. The WSM has been designed to collect reliable and comparable data on woodfuel production and consumption across the world.

The tables for the WSM are provided and can either be used directly or adapted to the specific situation of the country.

The WSM is designed to collect information on the consumption, acquisition, production and sale of woodfuel in the household sector and the informal sector. Data from these sectors are often missing from the data provided by developing countries to international organisations.

Specifically, the WSM covers the following topics:

- fuelwood use, collection and sales;
- charcoal use, production and sales;
- cooking and heating;
- health problems

It describes the indicators that can be built using the data gathered through the WSM, including a number of indicators from the SDG monitoring framework. Recommendations for data dissemination are also provided, to be defined based on the priorities and statistical needs of each country.

### Box V4.2.5: GIZ Establishing In-Use Vehicle Stock and Vehicle Mileages

In some countries, establishing the road fuel consumption of passenger cars and motorbikes from the official fuel sales may be impossible. The reasons may be a lack of reliable data, a large share of consumers refuelling abroad, or the presence of a strong black market for fuel. In any of these cases, an alternative secondary approach might be to calculate this consumption based on the following methodology.

$$\text{Total consumption (litres)} = \sum \text{vehicle stock}_i \times \text{average vehicle mileage}_i \text{ (km)} \times \text{fuel consumption}_i \text{ (litres/km)}$$

where

*vehicle stock<sub>i</sub>* = stocks of vehicles in use in the category

*average vehicle mileage<sub>i</sub>* = average mileage over the given period (e.g. year) of vehicles in use in the category

*fuel consumption<sub>i</sub>* = average fuel consumption of vehicles in use in the category

The average fuel consumption by type of cars can be obtained from the car specifications, and must be corrected for real driving conditions in the country. Vehicle stocks and average mileage can prove to be more difficult to estimate. In the paper 'Approaches for establishing in-use vehicle stock and vehicle mileages', GIZ has collected approaches that can be used in developing countries to assess these figures.

#### Vehicle stocks

##### Passenger cars

In most countries, a vehicle register exists. However, in developing countries it often contains most of the vehicles that have ever been registered, as vehicle owners rarely unregister their vehicles if they have no incentive to do so.

Two approaches may be used to estimate the actual number of passenger cars still in use:

- **Through the vehicle inspection data:** cars that do not show up for the compulsory regular inspection can be identified in the register as vehicles that are not in use. This approach requires:
  1. linking information from the vehicle inspections with the vehicle register;
  2. introducing a new variable/indicator for each individual entry in the vehicle database, indicating whether the car is in use or not.
- **Through secondary data sources:** such as:
  - o household surveys;
  - o living standard / income and expenditure surveys might contain information on the ownership of durable goods, among them cars and two-wheelers, as well as expenditure for fuel;
  - o insurance information: how many vehicles (cars) are insured?
  - o tax information: for how many vehicles (cars) is tax being paid?

To obtain the breakdown of vehicles in use by characteristics (e.g. type of fuel), the entire passenger car register should be amended by eliminating an appropriate number of old vehicles (based on the number of in-use vehicles identified above).

## Two-wheelers

In many countries, there is no requirement for two-wheelers to undergo regular vehicle inspections, and often no national two-wheeler register exists. Sometimes two-wheeler registrations are administered by the road traffic police, and these data may be available. If they are not, household surveys remain the most likely solution.

### How to establish vehicle stocks based on household surveys

Scaling up figures for a total (e.g. national) fleet from a survey sample requires reliable statistics on either the total number of households or the total population. To perform the scaling, the following should be done:

1. compute the number of vehicles per household/per person based on the household survey sample;
2. multiply the number of vehicles per household/per person by the total number of households/persons in the country.

If household datasets are used, expansion factors are used to counter survey selectivity:

$$\text{total national vehicle fleet} = \sum NV_i \times W_i$$

where

$NV_i$  is the number of vehicles of household  $i$  in the survey, and

$W_i$  is the expansion factor of household  $i$

It is also important to avoid double counting of vehicles in surveys. A possible solution is to formulate the question appropriately, for example: "How many vehicles are registered on individuals living in your household?"

## Vehicle mileage

### Passenger cars

Again, two main approaches can be used to estimate the average mileage per vehicle, in each category.

- **Through the vehicle inspection data:** (most reliable solution). This requires that the following information is collected at the inspection:
  - o the mileage on the odometer from the vehicles;
  - o the technical characteristics of the vehicle (age, fuel, type of powertrain).
 In order to extrapolate the average mileage for each vehicle group, two sub-approaches are possible:
- **Longitudinal vehicle inspection data** (most precise and reliable option): This consist in applying the following steps:
  1. Link the information from inspections to the vehicle in the register (e.g. through a unique vehicle identification number).
  2. Use the mileages from consecutive vehicle inspections to monitor the mileage trend for each vehicle category over time.
  3. Extrapolate the total mileages and average mileages per passenger car in each category.
- **Cross-sectional vehicle inspection data:** (if direct linkage of vehicle inspection data to vehicle data in the register is not possible). This implies the following steps:
  1. Collect all required technical information at the inspection.
  2. Extrapolate the overall average annual mileages.
- **Through surveys:** (if drawing mileages for passenger cars from inspections is not possible). Several options are possible:
  - o household mileage survey;
  - o household travel survey;
  - o on-street or intercept survey.

## Two-wheelers

For the same reasons as for the fleet size, mileages can often only be collected through a survey on a random sample of households, or by on-street or intercept surveys.

### How to conduct a household mileage survey

1. A sample of households is drawn, e.g. by random-route-walking.
2. Households are interviewed about their socio-economic characteristics and vehicle ownership (two-wheelers, cars and others).
3. Technical details of the vehicles are recorded:
  - o self-estimated annual, monthly or weekly vehicle mileage
  - o a cross-sectional odometer reading (km on odometer) on a given date
  - o repeated odometer readings, e.g. if the household is revisited after an adequate period of time (e.g. two months, 10 weeks).

This survey format requires reliable odometers. This should be tested with a suitable sample size of vehicle beforehand.

This method can also be combined with cross-sectional vehicle inspection data as it can deliver useful additional information to calibrate the extrapolation method.

### How to conduct a household travel survey:

1. A sample of households is drawn, e.g. by random-route-walking.
2. Households are interviewed about socioeconomic characteristics and vehicle ownership (two-wheelers, cars and others).
3. Multimodal travel information is recorded through a travel diary that differentiates the driver and passenger mode for cars and for two-wheelers.

This survey could also be combined with the household mileage survey.

**How to conduct an on-street or intercept survey:** as an alternative or supplement to a household survey, this can be implemented the quickest and deliver data the fastest: However, it provides less reliable data.

1. Drivers are stopped on the street or approached at suitable locations (e.g. gas stations) and interviewed on site.
2. Questionnaires cover basic technical information about the vehicle.
3. Mileage information is collected through self-estimated annual/monthly/weekly mileages and odometer readings.
4. The odometer readings can be extrapolated through a suitable modelling approach to total average annual mileages.
  - o must consider that high mileage vehicles have a higher likelihood of being covered by the survey due to the sampling procedure. This must be corrected by suitable design weights.

This survey format requires reliable odometers, and suitable testing sites.

### Box V4.2.6: IRENA Off-grid renewable capacity

Driven by technological innovation, falling costs, supportive public policies as well as new financial solutions, the production of off-grid electricity has increased tremendously in the past decade. Off-grid electricity includes both small, self-powered devices such as solar lights, solar home systems and street lights, as well as larger applications, such as mini-grids. Similarly, small scale biogas production offers great opportunities in terms of access to clean energy and is increasing rapidly in many countries. However, the collection of statistics for these applications is facing the same difficulties as for off-grid electricity.

The growth of this sector justifies the need for accurate monitoring (for instance, to track progress on objectives of access to electricity). However, by nature, measuring production in these applications is more difficult than for larger producers that supply electricity to the grid or for commercial biogas facilities, as there is often no monetary transaction associated with their use.

IRENA has published 'Measurement and estimation of off-grid solar, hydro and biogas energy', a note that describes methods used to measure or estimate recent trends in off-grid renewable energy production and use. It refers to various data sources that were used in IRENA's off-grid capacity database, including national sources, international databases and more.

The methodology description covers sources used to estimate the **electricity capacities** for:

- Off-grid hydropower
- Solar lights and solar home systems
- Solar mini-grids
- Solar pumps
- Biogas power plants

It also includes the sources used for estimating **biogas digester capacities**.

The assumptions made about lifetime expectancies for these applications are particularly useful as it is often easier to obtain the yearly capacity addition than the capacity in use.

Further, the actual energy production calculation method from all the above off-grid technologies is described. This includes assumptions made in terms of capacity utilisation factors, which are also a key element for the calculation. The proposed factors could be used in the absence of in-country measurements.

Finally, the production figures are used to calculate a level of energy access (following the tiered approach), and some information is provided regarding the assumptions on allocation of energy end-uses.

Additionally, tables presenting off-grid data by country and technology are included for reference.

### V4.2.4. Analysing quality of energy data and identifying problems

The quality of the energy data collected depends on the data accuracy, completeness, timeliness, coverage, and on its compliance with international recommendations and classifications in terms of definitions and methodologies.

The energy data validation procedure can be separated into three main categories:

- respect of the methodologies and definitions
- consistency validation (where each data point is evaluated in relation to others of the same reported period) and
- time series validation (where data points are observed across the entire time span collected).

In terms of the second type of validation, two main aspects of consistencies are to be evaluated:

- The arithmetic consistency: covers aspects such as the adequacy of the totals and the breakdown elements, as well as the ratio of the statistical difference to the totals, and the ratio between quantities reported as “Not specified” and the totals. It can also include a mirroring exercise for the international trade when it is reported by both trade partners.
- The physical consistency: covers issues such as: transformation efficiencies (ratio between energy output and input (e.g. electricity generation and coal combustion, or petroleum products and crude oil), as well as load factor (ratio between the actual production and the theoretical maximal production) and physical properties of the fuels (energy content).

In terms of time series checking, two main aspects can be identified:

- Trends: Any break in the series (start, stop, strong increase/drop) might indicate a data issue. In the case of monthly or quarterly data, the seasonality can add another layer of verification: the data can be compared to the same period in previous years to factor in the effect of the weather and other seasonal patterns. Trend analysis require the definition of a threshold above which the variation in the compared data is considered suspicious.
- Context: The identified trends are reviewed in light of the general energy context, such as policy effects (e.g. Nuclear plant decommissioning, subsidies for Solar PV, efficiency of appliances etc.), socio-economic effects (energy prices, population and GDP growth), weather effect (e.g. Hydro plant availability, energy demand for heating), specific events (e.g. accidents or wars in key regions) etc.

Furthermore, there are other types of validation such as the comparison between data revisions and between the same data points reported to different organisations. Such checks are carried out e.g. by regional organisations when validating the energy data provided by their member countries.

Within the European Statistical System (ESS), the ESSnet on Validation of Data (ValiDat) brought together a group

of National Statistical Institutes in the EU Member States to establish a generic reference framework for data validation.

Additional validation takes place downstream in the data process. The calculation of energy balances and other indicators, for instance, allows identification of potential data issues through the calculation of energy efficiency indicators, because it can normalize the figures (e.g. / by capita) and therefore allowing comparisons across countries.

### V4.2.5. Key issues for building or improving a statistical system in the energy sector

National Statistical Offices (NSOs) collect energy statistics from various sources. In order to improve or build a statistical system, it is therefore of primary importance to start by clearly identifying the data origin, then to establish an efficient institutional collaboration with the data providers and finally to establish the methodology and process to be used in order to ensure accurate and timely data submission.

Appropriate legislation related to the statistical work is the minimum requirement, and the starting point for developing national capacity. A well-defined statistical legislation should stipulate that national administrations:

- must dedicate an independent entity to oversee data collection (including a team for energy statistics);
- must oblige the respondents to provide information to this entity and put in place well-defined repercussions if they fail to do so. Otherwise some respondents could simply refuse to cooperate due to the additional burden;
- should additionally grant the entity access to data collected by other administrations (e.g. ministry of transports).

A formal service-level agreement or memorandum of understanding between the organisations involved is often necessary to align the interests of entities involved in the data collections. Such an agreement could cover:

- the access to administrative registers to obtain administrative data needed for energy statistics;
- the collaboration with managers of other surveys – households and industries – to obtain information to be used to produce energy statistics (and possibly to add new questions to these surveys);
- the implementation of procedures to ensure access to the data required.

Workshops with all partners can be organised to define the framework of the agreement, based on the statistics to be produced, and to organise the data collection.

The EU4Energy programme supports the countries of Eastern Europe, Caucasus and Central Asia in elaborating action plans for development of their energy statistics. Among the outcome of the projects, some recommendations were prepared which aimed at improving energy data quality and ensuring that statistics were disseminated and used to support policy-making.

Once the legal framework is in place, the dedicated authority (NSO, ministry) should act as the national focal point for data collection activities. Even if another entity collects certain type of information, the NSO should be aware of it and should have access to it. In an ideal world, a country should only have one dataset for each purpose. Regarding energy statistics, a commonly observed issue is that the statistical office and the Ministry of Energy display different figures for the same purpose (e.g. coal production). This obviously undermines the credibility of data and could for instance alarm potential investors, as the information seems unreliable. The NSO, as the national authority on statistics, should have a leading role as the facilitator of improving and consolidating the national energy statistics. In practice, this work should be done through a national energy statistics working group. This group can be formal/informal and meet regularly/on-demand, but the most important is to offer all the involved institutions a two-way channel to pass on information and receive feedback and above all agree on the methodology.

Adopting international standards for energy statistics presents great advantages, as it leads to improved transparency and international comparability of the official energy information. The usefulness of the collected information increases notably by aligning with the international methodology. This may require modifying existing surveys used for national energy data collection, but any new surveys should be aligned to correspond to the international standards from the start. The IRES is an essential document for the national statistical offices in developing countries when adopting the international methodology.

With that intent, it can be useful for developing countries establishing a new data collection system to review what has been done in other countries. The UNSD has developed the Energy Statistics Compilers Manual (ESCM)

in close collaboration with the Oslo Group to support the implementation of the IRES. It provides practical guidance for compilers of energy statistics and energy balances by describing country practices. The IEA also developed and maintains an online searchable database of best practices for collecting energy end-uses and activity data from the experience of different countries. This includes practices such as surveying, modelling, measuring etc.

Even once the relevant legislation is in place, when national institutions cooperate on a formal level and international statistical standards are adopted, real improvement happens only with capable experts. Human factor is at the core of successful energy data management and use. The number of staffs should correspond to the expected outputs (in terms of data coverage, frequency of publication), and focus should be put on increasing the expertise of the existing staff. Keeping in mind that the main areas of statistical work cover data collection, analysis and dissemination, all these areas should be supported through targeted technical training. The quality of the data and the punctuality of the publications are key factors for assessing the usefulness of the deliverables.

IRENA has published a structured methodology that countries can use to assess their capacity to produce renewable energy statistics. It describes requirements for effective data collection, highlighting some of the challenges often faced by countries in each area and suggesting improvements that can be made.

It is also useful to arrange workshops where data providers and users can exchange views, supported by external facilitation (e.g. regional or international organizations) in order to ensure that the dissemination is in line with the needs of the data users.

**To find out more...****International policy references**

- Sustainable Development Goals; in particular SDG 7 'Ensure access to affordable, reliable, sustainable and modern energy for all'; SDG 9 'Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation'
- African Union: Agenda 2063 – The Africa we want

**Methodologies and guidelines**

- UNSD: International Recommendations for Energy Statistics (IRES)
- Eurostat and IEA: Energy statistics manual
- Eurostat: Energy balance guide
- Eurostat: Methodology for data collections: Annual data; Monthly data; Price data
- ESSnet Valdat (Validation of Data): Methodology for data validation 1.0 – revised edition
- EU and IEA: EU4Energy – Strategic actions to support energy statistics
- IEA: Energy efficiency indicators: fundamentals on statistics (manual for statisticians) and Country best practice database
- UNSD: Energy Statistics Compilers Manual (ESCM) and database
- IRENA: Capacity needs assessment for renewable energy statistics
- IRENA: Measuring small-scale biogas capacity and production and Testing IRENA's biogas survey guidelines: Lessons learned in six countries
- IRENA: Measurement and estimation of off-grid solar, hydro and biogas energy
- UN FAO: Guidelines for the incorporation of a woodfuel supplementary module into existing household surveys in developing countries
- GIZ: Approaches for establishing in-use vehicle stock and vehicle mileages
- GIZ: Next steps under the Paris Agreement and the Katowice Climate Package

**Legislation, classifications and nomenclatures**

- Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics
- Regulation (EU) 2016/1952 of the European Parliament and of the Council of 26 October 2016 on European statistics on natural gas and electricity prices
- Council Directive 2009/119/EC of 14 September 2009 imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products
- Regulation (EC) No 223/2009 of the European Parliament and of the Council of 11 March 2009 on European statistics
- Standard International Energy Product Classification (SIEC)
- Central Product Classification (CPC)
- International Standard Industrial Classification of All Economic Activities (ISIC)
- Harmonized Commodity Description and Coding System (HS)

**Data sources**

- Eurostat: Energy statistics
- IEA: Energy Statistics
- IEA: Emergency oil stocks
- IRENA: Energy statistics
- JODI: JODI data
- UNSD: Energy statistics



# V4.3

## Agricultural, forestry and fishing statistics





## V4.3. Agricultural, forestry and fishing statistics

### *The chapter in brief*

This chapter covers agriculture, forestry and fishery statistics, as well as relevant satellite national accounts and price statistics. Due to the importance of these areas to central policy issues such as poverty reduction, hunger prevention, rural development and sustainable management of natural resources, international organisations are actively seeking to improve statistics as basis for decision making, monitoring and evaluation.

Small-scale and subsistence farming and fishing often make up a large part of these sectors in developing countries; both production and employment are often not captured by historical methods of statistical surveys and administrative data collection.

The chapter starts by identifying the main policy areas for which these statistics are used and continues by providing a user's view of the statistics involved. The chapter then identifies the main sources of data and information about methods, continues by discussing how to analyse the quality of the statistics in these fields and concludes with information on complementary sources

### V4.3.1. Policy applications: what this data is used for

Agriculture, forestry and fisheries statistics have a wide variety of uses, including:

- Providing timely information on agriculture, forestry and fisheries, which are key sectors for income, employment and provision of food and basic materials in most developing countries. These statistics cover both the structure of the sectors and their production of goods;
- Analysis of the production processes of the agricultural, forestry and fishing industries and the primary income and employment generated ;
- Supporting trade policy for agricultural, forestry and fishing goods, providing information on bilateral and multilateral trade issues and the impact of individual policies ;
- Monitoring sustainable use of natural resources such as fish-stocks and forests, protection of the environment such as water quality and soil degradation ;
- Provision of information for research, analysis and impact assessments on topics related to agriculture, forestry and fishing, quantitative studies such as forecasts.

The agricultural, forestry and fisheries policy objectives of countries with which the EU cooperates may differ considerably from EU policies, as may the sector structure. For these reasons, the statistics compiled and analysed outside the EU may differ considerably from those within the EU, even without taking budget constraints into consideration.

### V4.3.2. Concepts and definitions

The chapter covers a wide range of agriculture, forestry and fisheries statistics, including:

- agricultural production statistics
- censuses and surveys of agricultural holdings: farm structure, labour input, other inputs
- agricultural price statistics
- Economic accounts for agriculture
- food balance sheets
- agri-environmental indicators
- forest resources production statistics
- fisheries: statistics on fishing fleet, catch, landings, production, aquaculture
- summary of agriculture SDG indicators

This chapter does not deal with environmental statistics or statistics on rural development. Neither does it cover the specific statistical methodology and organisation of censuses and surveys in the areas covered.

Global methodologies and classifications have been developed so that statistics can be unambiguously understood and to make international comparisons. The implementation of these standards often needs to be adapted to the needs and the situation of individual countries. National statistical sources tend to focus on accurate representation, international publications on comparability of statistics. Sufficient statistics should be available to provide the information needed to analyse national and sub-national agricultural policies.

The core international initiative in the sector is the 'Global Strategy to Improve Agricultural and Rural Statistics', presented by the World Bank, jointly with the UN and FAO to the UN Statistical Commission in 2010 as a response to the declining quantity and quality of agricultural statistics and to the increasing demands for data, including from the Sustainable Development Goals (SDGs):

- A **Conceptual Framework for the Collection of Agricultural Statistics**, was based on a thorough assessment of users' data needs. It pointed to many emerging requirements from issues closely linked to agriculture such as poverty and hunger, the environment and climate change, the use of land and water, and the increasing use of food and feed commodities to produce biofuels. Based on these requirements, the conceptual framework broadens the scope and coverage of agricultural statistics to include aspects of fisheries, forestry, and rural households and provides a menu of indicators.
- **Identifying a Minimum Set of Core Data and Determining National Priorities**. Because the complete set of data requirements identified in the conceptual framework exceeds the existing statistical capacity of many countries, a minimum set of core data is to be used as a starting point upon which to develop the Global Strategy. This core set of

data will provide national and international policy makers necessary information that goes across national boundaries. The Global Strategy provides a framework for countries to add items of national interest to the set of core data and to determine the frequency with which they will be provided.

- **Integration of Agriculture into National Statistical Systems.** Overlapping data requirements and the need to improve underlying statistics and methodology point directly to the need to integrate agriculture into the national statistical system. Incorporating agriculture into national statistical systems will facilitate the concentration of resources from multiple sources, and remove the duplication of efforts in producing statistics.
- **Sustainability of Agricultural Statistics by Governance and Statistical Capacity Building.** The conceptual framework leading to the integration of agriculture into national statistical systems points to requirements for governance that bring together the efforts of the different stakeholders, especially the national statistical institutes and ministries of agriculture.

### V4.3.2.1 AGRICULTURAL PRODUCTION STATISTICS - CROP AND ANIMAL PRODUCTION

Agricultural statistics cover crops and animal production; basic processing; and inputs. They play a key role in the design, implementation and monitoring of agricultural policy and of food policy, including food security; provide information to agricultural markets; and also contribute to ensuring food safety and to providing data on climate change. Together with data on agricultural holdings, for which see next section, they provide the basis for many of the statistics considered later in this chapter, notably crop balances; for production forecasts; and for agricultural geographical information systems<sup>(55)</sup>.

At national level, publications should report statistics by administrative area, where appropriate. Data disaggregated by modern and traditional farming methods or by biome can in some cases be distinguished in national statistical publications. Within the EU, most data are collected at national level but some are available by NUTS 2 area.

Data collection has traditionally been through administrative systems or surveys. Administrative systems are questionnaires completed by farmers or agricultural extension workers. The information collected in this way in developing countries is often both inaccurate and slow.

Agricultural censuses and surveys, considered in the section below on Agricultural holdings, can produce more accurate results but are more expensive and are not necessarily faster. Remote sensing satellite imagery can also be used to estimate areas under cultivation. Subsistence farming is an important aspect for providing food security in many developing countries. It is therefore important to develop strategies for capturing or estimating this agricultural production. The Global Strategy favours statistical censuses and surveys to provide and utilise respectively a master sample frame;

<sup>(55)</sup> A global example is the FAO 'Gridded Livestock of the World', discussed in Box 17.2. below

administrative data is seen as a supplement in the general case.

Specialised surveys (or samples within larger surveys) can provide information about genetic diversity, hence SDG indicators 2.5.1 and 2.5.2.

Crop statistics cover the area harvested, yield and production quantity. Yield, as production per area, should be consistent with the other two statistics (but may not be in practice). Crops can be grouped into cereals, oilseeds; dry pulses; root crops; fibre crops; vegetables; and permanent crops (fruit, nuts, berries, vines and olives).

Processed crops include production of oils, basic sugar products, cotton products and others. These are manufactured goods and so are often presented under production statistics – Eurostat present processed crops under PRODCOM.

Statistics are collected on stocks of live animals, including poultry. Livestock statistics cover numbers of producing / slaughtered animals; yield in terms of carcass weight; and production quantity in weight or egg count. Again, the yield data should be calculable from the other statistics. Agricultural inputs cover statistics on fertilizer and pesticide use for agriculture. Fertilizers can be measured by type of nutrient or product. Pesticide sales and use in agriculture is measured by product type: insecticides, herbicides, fungicides and others.

Regulation (EC) No 1165/2008 concerning livestock and meat statistics describes in detail the collection, validation and dissemination of data, analysis of methods and update of metadata information.

EU statistics on crop products are collected under Regulation (EC) No 543/2009 as amended by Commission delegated Regulation 2015/1557. Methodologies for Eurostat's data collection in the EU are given in Annual Crop Statistics Handbook. Statistics are obtained by sample surveys, supplemented by administrative data and estimates based on expert observations. Sources vary from one EU Member State to another because of national conditions and statistical practices. National Statistical Institutes or Ministries of Agriculture are responsible for data collection in accordance with EU Regulations. The statistics relate to more than 100 individual crop products.

### V4.3.2.2 AGRICULTURAL CENSUSES AND SURVEYS ON THE STRUCTURE OF AGRICULTURAL HOLDINGS

Statistics on agricultural holdings (households or companies), are collected using censuses and surveys. In developing countries, data on households producing crops and livestock for own use as well as for local markets are necessary to get exhaustive information about the agricultural sector.

The data describes the structure of agricultural holdings. The data is often used in conjunction with population census information to derive social indicators.

The following SDG indicators are directly informed by surveys of agricultural holdings:

- 2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size
- 2.3.2 Average income of small-scale food producers, by sex and indigenous status
- 5.a.1 Women's ownership of agricultural land

A census of agriculture collects data on the structure of agriculture, covering the whole or a significant part of the country. Typical structural data collected in a census of agriculture are size of holding; areas under cultivation, grazing and other use; livestock numbers; labour; irrigation; tools, equipment and machinery; and land tenure.

The 'Global Strategy to Improve Agricultural and Rural Statistics' notes that:

*'The coverage of agricultural statistics should be as exhaustive and as comprehensive as possible, and any omission of units based on their size, importance, location, or other criteria should be avoided. Many countries apply such criteria to reduce the costs of collecting data. ... This selective focus leaves smaller plots and remote parts of a country unrepresented in agricultural statistics, although these areas may account for a majority of the country's food insecurity and poverty. The omission of small-holder and household plots also deprives decision makers of information about local subsistence strategies or the amount of income households receive from selling produce from gardens and small plots. Because many small holdings are often the responsibility of women, the omission of this information overlooks a key source of gender-disaggregated data on well-being.'*

The 'Global Strategy' explains the relationship between the agricultural census which creates / updates the 'master sample frame' and, based on this, periodic sample surveys:

The master sample frame is to be constructed based on the requirements to include both households and farms as statistical units. It provides a link between the census framework and land use. An integrated survey framework will be established to provide data measured consistently across time and comparable across countries using an annual survey of selected core items and periodic data from a set of rotating panels covering economic and environmental issues.

As noted by the 'Global Strategy', 'The basic unit for social statistics is the household; for environmental statistics it is the land parcel. The challenge will be to link these statistical units.' Measurement and recording are made much easier by geo-referencing and maintaining a geographical information system of all the data collected. This method incorporates the traditional 'farm register' and allows alternative names and descriptions of land holdings to be maintained.

The FAO's 'World Programme for the Census of Agriculture 2020' (WCA 2020) presents guidelines for the ten yearly agricultural census round to be carried out between 2016 and 2025 with the objective of providing internationally

comparable data while addressing emerging information needs:

*This publication features the discussion of four modalities for conducting a census of agriculture: the classical (one-off) approach, which is still widely used; the modular approach ...; the integrated census/survey modality, involving rotating survey modules over the years between two censuses; and the combined census modality, which uses administrative data. The distinguishing features are in the design of these four modalities and not in whether complete or sample enumeration is used. Another important feature .... [is] the notion of "essential" items, and a clear distinction between "essential" items and "frame" items. It is recommended that all countries collect the essential items regardless of the census modality. The frame items are intended primarily for inclusion in the core module of a census using the modular approach, to provide data for the frames for the supplementary modules or follow-up surveys.*

The treatment of food security is updated in WCA 2020, introducing the new standard Food Insecurity Experience Scale (FIES), which can be applied in a census or survey. Subsistence, informal, nomadic and shifting cultivation are covered by WCA 2020.

Each statistical collection should be carried out as a component of the national statistics system, whether by the statistics institute, agriculture ministry or agency or other organisation.

The World Bank implements, with national partners, the Living Standards Measurement Study - Integrated Surveys on Agriculture (LSMS-ISA), a household survey project:

*Recognizing that existing agricultural data in the region suffers from inconsistent investment, institutional and sectoral isolation, and methodological weakness, the LSMS-ISA project collaborates with the national statistics offices of its eight partner countries in Sub-Saharan Africa to design and implement systems of multi-topic, nationally representative panel household surveys with a strong focus on agriculture. The primary objective of the project is to foster innovation and efficiency in statistical research on the links between agriculture and poverty reduction in the region.*

*In each partner country, the LSMS-ISA supports multiple rounds of a nationally representative panel survey with a multi-topic approach designed to improve the understanding of the links between agriculture, socioeconomic status, and non-farm income activities. The frequency of data collection is determined on a country-by-country basis, depending on data demand and the availability of complementary funding.*

In the EU, the Farm Structure Survey, carried out every 3-4 years with a census every 10 years, provides data on land use, livestock farming and the agricultural labour force. They are based on Regulation 2018/1091. The basis is a standard EU definition of an agricultural holding. The survey is also the statistical basis for sample surveys on land use, livestock and agricultural income. The results form the basis

of Eurostat's agriculture statistics and are used for the EU Farm Accountancy Data Network (FADN), an instrument for evaluating the income of agricultural holdings and the impact of the Common Agricultural Policy.

### V4.3.2.3. AGRICULTURAL PRICE STATISTICS

Agricultural price statistics provide information on agricultural products at farm gate, on agricultural inputs and at other points in the value chain. Changes in prices are the most common measurements but the comparison of price levels between different areas can also be important.

Various price measurements are used to measure farm income; measure local price changes; provide early warning of changes to food security; form part of national consumer and producer price indices used to measure inflation and (less frequently) the national price level; and provide global commodity prices as international economic indicators.

Agricultural surveys (see above) and administrative returns provide information about quantities sold and income received, so that the basic price received by the producer can be calculated. Data collection for the producer price index serves the same purpose and can be integrated.

Prices of basic goods observed on local markets may differ in both level and trend between various parts of a country, due to transport costs, local market structure, different income levels and availability. Food prices are collected in local shops and markets for the consumer price index. In some localities, prices of basic food commodities are more frequently collected as a food security early warning indicator. Price collection for these two purposes should be integrated.

Export unit prices can be calculated for agricultural products provided that quantity data are collected. Where available, these indicators depict the prices received by exporters – potentially useful for economic management in countries whose major exports are agricultural products.

Finally, international commodity prices track world markets. Price levels and volatility can influence the planting decisions of farmers in many developing countries. Commodity price indices provide a means of tracking price changes over time. Monthly and seasonal average prices vary between reporting agencies, due to detailed definitional differences.

Prices of inputs to developing country agriculture are most relevant when collected in agricultural surveys or the producer price index.

Of interest also is the International Comparison Project, globally coordinated by the World Bank, which develops purchasing power parities based on comparable prices. Agricultural products and inputs figure significantly in the product baskets. This data can be used for Economic Accounts for Agriculture (see next section).

European Union metadata and methodology for agricultural price statistics, can be found in the Eurostat metadata server and the Handbook for EU Agricultural Price Statistics.

### V4.3.2.4 FOOD BALANCE SHEETS

Food Balance Sheets (FBS) systematically measure food availability within a country so informing food policy, in particular food security. As a proxy for food consumption, derived indicators can be used to measure risk of hunger, malnutrition, import dependence and food self-sufficiency, as well as for other purposes. Food balance sheets provide this information by accounting for the sources and uses of all food commodities, incorporating changes in stocks, products used for processing, products used by the producers, etc.

Common uses of food balance sheets are:

- Measuring and analysing overall food supply – to estimate a country's overall Dietary Energy Supply (DES) and macronutrient availability
- Food supply assessment through the calculation of derived indicators, covering hunger, malnutrition, import dependence and food self-sufficiency, notably Prevalence of Undernourishment (PoU)
- Benchmarking and market analysis: comparing food availability from one country to another, both on an aggregate level and on a product-specific level, including for market research.
- Comparing food availability across time including estimated total caloric availability, growth of consumption in new products, and general changes in dietary composition. Policy uses include tracking obesity rates.

The FAO 'Guidelines for the compilation of Food Balance Sheets' describe the food balance sheets and their primary uses as:

*... an aggregated and analytical data set that "presents a comprehensive picture of the pattern of a country's food supply during a specified reference period. This is achieved within an accounting framework, wherein all potential sources of both supply and utilization of a given food product are specified. The quantities allocated to all sources of total supply – the amount of the food item produced, the amount of the food item that is imported, and the amount of the item that is either added to or taken from stocks – must be equal to the quantities allocated to all sources of utilization, which can include exports, losses along the supply chain, livestock feed, seed use, tourist food, food processing, industrial uses, other uses, and food available for consumption by a country's residents. This balance is compiled for every food item ... consumed within a country, and all of the primary commodity equivalent balances are then combined into a single overall FBS. An estimate of per capita supply for each food item – both in terms of quantity and, through the application of food conversion factors, in terms of caloric value, protein, and fat content – can then be derived by dividing by the country's population. These per capita estimates of caloric value for individual food products are then summed to obtain the total daily per capita Dietary Energy Supply (DES) of a country.*

*Because FBS track overall food availability and not actual consumption, the DES cannot be used as an estimate of how*

*much nourishment the average resident is consuming, but rather as an indicator of whether sufficient food is available nationally, particularly for developing countries, where undernourishment is more likely to be a problem. ... FBS are also useful for analysing the overall content of a country's diet, including determining the availability of a certain variety of food. ... In the context of developing countries, analysing shortfalls in the availability of certain foods in the FBS could be one approach to better understand the nature of malnutrition in a given country.*

*... To the extent that the methodology for compiling FBS and deriving DES estimates is similar across countries, these estimates can be used to compare food availability from one country to another. This comparison is possible both on an aggregate level and on a product-specific level.*

The agricultural production, price and farm income and consumption statistics described above provide the source data used by the Food Balance Sheet, supplemented by trade data and potentially by data from specific surveys, such as on consumption by tourists and product loss at intermediate stages of the supply chain. The 'Guidelines' claim that FBS can be usefully compiled even with limited source data, provided that appropriate methodology is followed. At the same time, the Guidelines recommend **'that countries invest resources in improving the measurement of input data before attempting to compile country-level FBS.**

***There is no substitute for input data measurement, and reliable FBS depend upon reliable input data.*** Retention of metadata is also important to provide institutional memory from one FBS compilation exercise to the next.

The 'Guidelines' recommend that FBS coverage should cover *'products that represent at least 90 percent of total caloric consumption, as identified in household consumption surveys. ... at least the most-consumed commodities in each commodity group are represented'*. Regional or subnational FBS accounts can be compiled to better target food security policies within countries that have wide regional disparities, requiring additional methodologies and data sources.

The 'Guidelines' note that production of a FBS ***'can be time-consuming and require additional resources for agricultural statistics and analysis.'*** ***On the other hand, as noted in the 'Guidelines', FBS provides 'a framework for reconciling data, as total supply must equal total utilization. ... for most countries and most products, the necessary input data will come from a variety of different sources and agencies within the government, and potentially even from semi-official actors providing information on a single commodity. While reconciling these data may be time-consuming, the process provides a unique opportunity to both harmonize data collection efforts across agencies...'***

The European Commission DG AGRI-JRC produces an EU-wide Food Balance Sheet and simplified FBS, updated three times a year. Methodological information is available and can serve as a reference point.

The Food Balance Sheet is a physical accounting framework.

#### **V4.3.2.5 ECONOMIC ACCOUNTS FOR AGRICULTURE**

Economic Accounts for Agriculture (EAA) utilise a corresponding money-based supply-use framework to provide a satellite account to the national accounts, covering in detail the agricultural products and services sold by agricultural units, held in stocks on farms, or used for further processing by agricultural producers, in conformity to the System of National Accounts (SNA).

Economic Accounts for Agriculture support analysis of the value added and labour input in the agricultural sector and provide information on the economic situation of a country's agriculture and on interdependencies within the sector. They provide monetary values for farm income and along the value chain. Hence, they can potentially provide information on rural poverty and on agricultural market opportunities. They are used for policy analysis and sector forecasting. In the European Union and Enlargement Countries, the EAA provide the information basis for the Common Agricultural Policy.

The EAA framework is ambitious, requiring comprehensive input data that can be adapted to a consistent framework. They are of greatest interest to countries with a significant agricultural sector and relatively well developed agricultural statistics and national accounts.

The EAA cover agricultural products and services produced over the accounting period. The main indicators are labour input, output, intermediate consumption, gross and net value added, compensation of employees, other taxes and subsidies on production, net operating surplus or net mixed income, property income, net entrepreneurial income, etc. at current and at constant prices. The Economic Accounts for Agriculture consist of a sequence of inter-related accounts:

- the production account
- the generation-of-income account
- the balancing items 'value added' and 'operating surplus'

The EU Economic Accounts for Agriculture are based on the European System of Accounts 2010 and defined by Regulation (EC) No 138/2004 of the European Parliament and of the Council on the economic accounts for agriculture in the Community

#### **V4.3.2.6 AGRI-ENVIRONMENTAL INDICATORS**

Agri-environmental indicators illustrate the interactions between agriculture and the environment. Common objectives are to:

- track the impact of agriculture and farm policies on the environment
- assess the impact of agricultural and environmental policies on environmental management of farms

- monitor environmental impacts on agriculture

Food security motivates much of this work in developing countries. In the EU, agricultural policy is a major driver. Climate change is of global interest. Land use; natural resource depletion; and soil and water contamination are the other common areas of policy focus.

A Literature Review and Key Agri/Environmental Indicators as: water; land use and soil; climate change and air quality; and biodiversity and landscape.

The FAO/OECD/Eurostat agri-environmental dataset identifies the following domains and within these close to 30 indicators:

1. Air and climate change
2. Energy (use in agriculture and bio-energy production)
3. Fertilizers
4. Land (area, use-change, irrigation, conservation, cropping patterns and organic, protection)
5. Livestock
6. Pesticides
7. Soil (erosion, degradation and carbon)
8. Water
9. Emissions by sector
10. Emissions intensities

Indicators must be relevant to national and local conditions. This makes international comparisons difficult. The FAO study 'A Literature Review and Key Agri/Environmental Indicators' provides alternative indicators within each domain to ensure adequate coverage, relevance and, to the extent possible, comparability.

Agri-environmental indicators are derived from a wide variety of statistical sources, including from the agricultural statistics described in the previous sections. Therefore, when designing agricultural surveys and administrative data collection, the compilation requirements for agri-environmental indicators need to be considered.

FAOStat contains a wide collection of agri-environmental statistics. An example of a specialist agri-environmental statistical dataset is the FAO / EU 'Agriculture Stress Index System 2' (ASIS2). This provides **'a quick-look indicator for the early identification of agricultural areas probably affected by dry spells, or drought in extreme cases'**, as part of the FAO's 'GIEWS - Global Information and Early Warning System'. This **'monitors the condition of major food crops across the globe to assess production prospects. To support the analysis and supplement ground-based information, GIEWS utilizes remote sensing data that can provide a valuable insight on water availability and vegetation health during the cropping seasons.'**

Indicators that measure agri-environmental states or conditions sometimes do not measurably change over a one year period. When data collection and compilation costs are significant, intermittent international cross-sectional data for the same year is the norm. In this respect, the 'Global Strategy' notes that:

*A fundamental way to evaluate agriculture's effect on the environment is to monitor changes in land cover and use. Land cover does not change rapidly and data are not, therefore, required on an annual basis. However, mapping products or digitized data from remote sensing should provide complete coverage for the entire land mass of a country ...*

Another example of intermittent data compilation is the FAO Global Livestock Environmental Assessment Model, whose objective is:

*'...to quantify production and use of natural resources in the livestock sector and to identify environmental impacts of livestock in order to contribute to the assessment of adaptation and mitigation scenarios to move towards a more sustainable livestock sector.'*

The reference data is for 2010, although an update is planned.

The EU agri-environmental indicators (AEIs) are used for monitoring the integration of environmental concerns into the Common Agricultural Policy (CAP) at EU, national and regional levels. A set of 28 indicators was developed by the European Commission and Member States; Eurostat disseminates the available indicator fact sheets and identifies the data provider for each indicator. Broadly, they provide the following functions:

- provide information on the farmed environment
- track the impact of agriculture on the environment
- assess the impact of agricultural and environmental policies on environmental management of farms
- inform agricultural and environmental policy decisions
- illustrate agri-environmental relationships to the broader public

The System of Environmental-Economic Accounting (SEEA) is a statistical standard for environmental-economic accounting, incorporating agriculture, forestry and fisheries. This builds on the EAA framework described in the previous section and provides a similar consistent framework. The UNECE dedicated website notes that it 'is a source of information for SDG monitoring, especially for SDGs 6, 7, 8, 12, 13, 14 and 15.' The United Nations SEEA website defines the standard as follows:

*The System of Environmental-Economic Accounting (SEEA) is a framework that integrates economic and environmental data to provide a more comprehensive and multipurpose view of the interrelationships between the economy and the environment and the stocks and changes in stocks of environmental assets, as they bring benefits to humanity. It contains the internationally agreed standard concepts, definitions, classifications, accounting rules and tables for producing internationally comparable statistics and accounts. The SEEA framework follows a similar accounting structure as the System of National Accounts (SNA). The framework uses concepts, definitions and classifications consistent with the SNA in order to facilitate the integration of environmental and economic statistics.*

### V4.3.2.7 FORESTRY STATISTICS

Data on forest cover and on changes in land use/cover in forest areas provides evidence for monitoring and sustainable forest management policies, especially concerning climate change and also for local population income and food security.

The core indicators recommended for compilation by the 'Global Strategy to Improve Agricultural and Rural Statistics' are:

- Area in woodlands and forests; quantities removed; and their prices for land associated with agricultural holdings.
- Area in woodlands and forests; quantities removed; and their prices for products from non-agricultural holdings and respective utilizations.

Work on forestry production statistics at international level is coordinated by FAO, Eurostat, UNECE and the International Tropical Timber Organization (ITTO) through the Intersecretariat Working Group on Forest Sector Statistics. The separate institutions compile statistics on the production and trade of wood from national sources through their annual Joint Forest Sector Questionnaire (JFSQ), covering wood removal, production and trade.

The FAO 'Guidelines on data collection for national statistics on forest products' describes the uses of forest statistics; the forest production chain the JFSQ used to measure it and the associated statistical standards; the design of the statistical sample frames and surveys; the means of data validation and reconciliation; and the design of indicators and statistical presentations.

The data is reported by FAO through the Global Forest Resources Assessment (FRA). This 'provides essential information for understanding the extent of forest resources, their condition, management and uses. Forests are more than trees and fundamental for food security and improved livelihoods. They contribute to resilience of communities by regulating water flows, providing food, wood energy, shelter, fodder and fibre, generate income and employment as well as harbour biodiversity. Furthermore, forests support sustainable agriculture and human well-being by stabilizing soils and climate.'

Coverage consists of:

1. Extent area
2. Forest characteristics
3. Growing stock, biomass and carbon
4. Production and multiple use
5. Biodiversity and protected areas
6. Ownership of forests
7. Management rights of public forests
8. Employment in forestry

Data is every five years; the most recent cycle published refers to 2020.

The Global Forest Resources Assessment makes use of satellite remote sensing surveys in order to 'build country capacities to use remote sensing for forest monitoring as well as to generate independent, robust and consistent estimates of forest area and its changes over time at global, regional and biome levels'.

FAO's general statistical database FAOStat also contains information on forestry production and trade, forestry trade flows and forest land CO<sub>2</sub> emissions.

In the EU, annual data is also compiled to produce 'Integrated environmental and economic accounts for forests' (IEEAF). These satellite accounts of the European System of Accounts, similar to the EU Economic Accounts for Agriculture.

### V4.3.2.8 FISHERIES STATISTICS

Statistics on fishery resources inform policy making for sustainable fisheries management, commercial decisions and trade policy. Since fish is a major source of food and household income, living conditions and nutrition policies are also relevant for fishing communities. Statistics are used to track the impact of fisheries on natural resources and environments.

Data are collected on fisheries production, transformation, trade and consumption, classified by capture of fish in the open sea, captures in coastal zones managed by each country, captures from rivers and other fresh water sources, as well as aquaculture. Countries are responsible for providing statistics on all fisheries and aquaculture within their national jurisdiction, including their exclusive economic zone as well as conducted by vessels that sail under their flags. Food balance sheets for fisheries and fishery products reconcile sources and uses.

The 'Global Strategy to Improve Agricultural and Rural Statistics' recommends focusing on statistics which give information on food supply:

- Quantity of fish landed and discarded, number of days fished, amounts processed for food and non-food uses, prices, and imports and exports.
- For aquaculture: area cultured, production, prices, and net trade of imports and exports

FAO is directly concerned with sector statistical methodology, having published the 'Strategy for Improving Information on Status and Trends of Capture Fisheries' in 2003. The Coordinating Working Party (CWP) on Fishery Statistics **'provides a mechanism to coordinate the statistical programmes conducted by regional fishery bodies and other intergovernmental organizations with a remit for fishery statistics.'** FAO, Eurostat, OECD and regional and global fisheries, conservation and ocean study organisations participate.

The motivation for and content of the CWP Handbook of Fishery Statistics Standards are as follows:

***Considering capture fisheries and aquaculture from a global or a regional perspective requires national fisheries***

*statistical programmes to be coherent and consistent and demands a common set of regional or interregional statistical standards which apply internationally recognized definitions, classifications and codes.*

*The CWP Handbook covers the concepts, definitions, classifications and data exchange protocols – and not least the codes as applied to capture fisheries and aquaculture statistics globally. ... The Handbook indicates the principles applied by the international agencies and no attempt has been made to include details of national systems, many of which, having been developed for specific national purposes, may differ from those employed internationally.*

Regional Fishery Bodies coordinate data collection by national reporting offices and management of fishery resources and fisheries. Data collected by Regional Fishery Bodies generally contain detailed information on operational and biological aspects of capture fisheries. Thus, the Indian Ocean Tuna Commission (IOTC), 'an intergovernmental organisation responsible for the management of tuna and tuna-like species in the Indian Ocean', compiles and publishes statistics; provides capacity building; and sets and monitors compliance with fishing standards.

Regional Fishery Bodies coordinate data collection by national reporting offices and management of fishery resources and fisheries. Data collected by Regional Fishery Bodies generally contain detailed information on operational and biological aspects of capture fisheries. Thus, the Indian Ocean Tuna Commission (IOTC), 'an intergovernmental organisation responsible for the management of tuna and tuna-like species in the Indian Ocean', compiles and publishes statistics; provides capacity building; and sets and monitors compliance with fishing standards.

Fish contribute to food security in developing countries, both as a source of income and as a basic food. A sourcebook on 'Design and Implementation of Fishery Modules in Integrated Household Surveys in Developing Countries' has been produced by the World Bank as part of the Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA) project, in conjunction with the World Fish Center, an NGO. The document provides technical guidance on the design of statistical modules and questionnaires aimed at collecting fishery data at household level. It also outlines the background of main policies relevant to the fishery sector. Information on the data needed to analyse issues of policy relevance, and methodology on the construction of survey questions to collect necessary data are also provided.

FAO has a global remit to publish statistics on fisheries and aquaculture. The main recommended data source is the 'Yearbook of fishery and aquaculture statistics.' It contains data on:

- capture production, fleet and employment
- aquaculture production
- commodities
- food balance sheets

FAO's database FishStatJ is currently (2020) more suited to sector specialists. World Fish Center also supports a global fish species database.

Fisheries statistics are compiled by Eurostat from official national sources for the EU Member States and members of the European Economic Area (EEA) using international concepts and definitions. Production statistics from aquaculture, catches and landings cover fishery products taken for all purposes by all types and classes of fishing units and by area. Eurostat fisheries statistics are designed to meet the data requirements of the Common Fisheries Policy (CFP). The focus is on the statistics required for control and support of management and sustainable exploitation of fisheries resources.

Collected EU recommended methodologies can be found in Eurostat's handbooks on 'Aquaculture' and 'Catches and Landings'. A view of the objectives of sector statistics is provided by 'Evaluation of the European Fishery Statistics', which assesses the implementation and impact of the five European fisheries statistical regulations and the use and impact of the resultant statistics.

Interestingly, the EU food balance sheets do not include fisheries products. Instead, a DG MARE project European Market Observatory for Fisheries and Aquaculture Products (EUMOFA) publishes statistics, based on those of Eurostat, which include a supply-side balance sheet for the EU, as well as other sector data

### V4.3.2.9 AGRICULTURE SDG INDICATORS

FAO acts as top-level custodian for 21 of the SDG indicators related to the following Sustainable Development Goals:

- SDG 2 Zero hunger
- SDG 5 Gender equality
- SDG 6 Clean water and sanitation
- SDG 12 Responsible consumption and production
- SDG 14 Life below water
- SDG 15 Life on land

The following table shows where the material related to each SDG indicator is covered in this chapter.

**Box V4.3.1: SDG indicators considered by this chapter**

| <i>SDG / Indicators</i>   | <i>Where considered</i>  |
|---|--|
| <b>SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture</b>  |  |
| 2.1.1 Prevalence of undernourishment  | V4.3.2.2 Agricultural censuses and surveys and others                              |
| 2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)  | V4.3.2.2 Agricultural census and surveys<br>V4.3.2.3 Agricultural Price Statistics |
| 2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size  | V4.3.2.2 Agricultural holdings   |
| 2.3.2 Average income of small-scale food producers, by sex and indigenous status  | V4.3.2.2 Agricultural holdings   |
| 2.5.1.a Conservation of plant genetic resources for food and agriculture  | V4.3.2.1 Agricultural production statistics - crop and animal production           |
| 2.5.1.b Conservation of animal genetic resources for food and agriculture   | V4.3.2.1 Agricultural production statistics - crop and animal production           |
| 2.5.2 Proportion of local breeds classified as being at risk of extinction  | V4.3.2.1 Agricultural production statistics - crop and animal production           |
| 2.a.1 Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries | V4.3.2.2 Agricultural censuses and surveys   |
| 2.c.1 Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility  | V4.3.2.3 Agricultural Price Statistics   |
| <b>SDG 5: Achieve gender equality and empower all women and girls</b>   |  |
| 5.a.1 Women's ownership of agricultural land  | V4.3.2.2 Agricultural census and surveys   |
| 5.a.2 Women's equal rights to land ownership  |  |
| <b>SDG 6: Ensure availability and sustainable management of water and sanitation for all</b>  |  |
| 6.4.1 Water use efficiency  | V4.3.2.6 Agri-environmental statistics   |
| 6.4.2 Water stress  | V4.3.2.6 Agri-environmental statistics   |
| <b>SDG 12: Ensure sustainable consumption and production patterns</b>   |  |
| 12.3.1 Global food losses   | V4.3.2.2 Agricultural censuses and surveys   |
| <b>SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development</b>   |  |
| 14.4.1 Fish stocks sustainability   | V4.3.2.8 Fisheries statistics  |
| 14.6.1 Illegal, unreported unregulated fishing  |  |
| 14.7.1 Value added of sustainable fisheries   | V4.3.2.8 Fisheries statistics  |
| 14.b.1 Access rights for small-scale fisheries  |  |
| <b>SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss</b>   |  |
| 15.1.1 Forest area  | V4.3.2.7 Forestry statistics   |
| 15.2.1 Sustainable forest management  | V4.3.2.7 Forestry statistics   |
| 15.4.2 Mountain Green Cover   |  |
| Data on progress on these indicators can be found at the FAO publication 'Factsheets on the 21 SDG indicators under FAO custodianship. A highlight of the main indicators with the greatest gaps in country reporting', 2020.   |  |

### V4.3.3. Sources of data and metadata

Statistics on agriculture, forestry and fishing are mostly compiled at national level. National statistical publications, from national statistics institutes, agriculture and other ministries or other public agencies, should, in principle, follow international guidelines at the same time as responding to the reporting needs of the country and of sub-national regions. Where appropriate, distinct biomes should be reflected in the data.

International organisations publish agriculture, forestry and fishery transport statistics for their member countries. The Food and Agriculture Organization of the United Nations (FAO) has a global mandate. Regional and member organisations such as Eurostat, the United Nations Economic Commission for Europe (UNECE) and the Organization for Economic Co-operation and Development (OECD) publish statistics covering their member countries and often have an influence on statistical standards.

The most important data source for worldwide statistics on agriculture, forestry and fisheries is FAO, which publishes statistics on agriculture, forestry and fishery in both general and specialist databases. FAOStat, its generalist on-line database, contains time-series from over 210 countries and territories, covering statistics on production, inputs, agriculture emissions, land use & emissions, trade, food balance, food security, investment, agri-environmental indicators, prices, forestry, R&D indicators and emergency response.

FAO's CountrySTAT is a web-based information technology system for food and agriculture statistics at national and sub-national levels. It provides access to statistics on production, prices, trade and consumption. The CountrySTAT aims to harmonise information on food and agriculture among its member countries. The data are owned and maintained by the countries themselves. CountrySTAT gathers and harmonises scattered institutional data, so that the information becomes consistent within the country and compatible with data at the international level. FAO forms partnerships with statistical offices and the ministries of agriculture, fisheries and forestry to introduce the system and build the national capacity to use it. In each country, the national government makes a substantial contribution to ensure its deployment and continued training and maintenance. Unfortunately, as at 2020, most of the datasets have not been kept up to date.

In addition to these main datasets FAO supports many specialist statistical databases. Some of these are discussed in the relevant parts of section 17.2 above; others are shown in Box V4.3.2 – links are at 'To find out more - data sources'.

UNECE disseminates forestry statistics and some data on agriculture for about 50 countries. Several indicators are available for forestry statistics: forest resources, forest health and vitality, productive functions, biological diversity, protective functions and socio-economic functions.

The OECD collects and publishes data on agriculture, and trade, sustainable agriculture, pesticides and fisheries through its OECD-FAO Agricultural Outlook database.

Eurobase, Eurostat's free dissemination database provides rich and high quality information agriculture, forestry and fisheries in the European Union, European Economic Area and enlargement countries, as well as a range of methodological notes and guidelines.

### V4.3.4. Analysing data quality and identifying problems

The quality of data for agriculture, forestry and fisheries depends on data coverage and disaggregation, the timeliness of the published figures and their compliance with the agreed methodology. For comparisons and analyses, international standards and classifications should be respected. All statistical publications should be accompanied by 'sources and methods' documentation.

An understanding of the appropriate data concepts, of the methodologies that were used in compiling the statistics and any differences between them can be important to interpreting the statistics correctly.

Statistics from international organisations are generally intended to be comparable between countries. Since many countries adapt the international statistical standards to meet their specific needs, it is very common, especially in developing countries, for the international agencies to adjust national data to ensure comparability. Therefore, the statistics published by national and international sources may differ, even if they originate from the same statistical exercise. While this situation occurs in many areas of official statistics, it is more marked in these sectors. For example, a 'year' may refer to a 'calendar year' or a 'season or harvest year'. Both concepts are useful in different contexts. Where international data sources have adopted different standards, statistics published by these agencies may differ. The Agricultural Market Information System (AMIS) explicitly compares commodity price data produced by FAO-AMIS, the US Department of Agriculture and the International Grains Council. For the reasons outlined, statistics may even differ between datasets from the same international agency.

Noting again that there are good methodological reasons why statistics from developing country national sources may differ from the data in international publications, similar data from both publications indicates that the international institution accepts the national methodology. On the other hand, historically there have been cases in other statistical fields where developing country national statistical institutes have contested the interpretation of their data by international agencies. More commonly, communications problems between national and international agencies may mean that recent national data is not reflected in international publications.

Where national data is missing, global agencies resort to estimation or imputation to ensure complete datasets. The resulting figures are flagged. Various means exist to produce estimated or imputed data. The ideal situation occurs when past data for the country and current data for comparable countries are both available. Estimation methods can then make use of pooled time-series and cross-section data. This is the case for much of Eurostat's data estimation. These techniques are not always possible in a developing country context. Imputations, either in national or international data sources, based on a repeatedly imposed annual percentage or value change should be viewed with suspicion.

Timeliness is especially important for agricultural production statistics: the data is better consumed fresh. For example, data about a record harvest have little information value if they become available only a year after the harvest.

Coverage is a critical factor for the completeness of agricultural and fishery statistics in developing countries which entails the incorporation of subsistence producers through surveys. Statistics based on purely administrative sources are likely to exclude much subsistence production.

National publications from different ministries, agencies and sub-national administrations may cover the same statistics with different values, especially for administrative agriculture statistics. Competing data sources are a sign of an imperfectly coordinated national statistical system. There is no prior means of identifying which, if any, of the sources is accurate.

Especially where the national statistical system is not fully functioning, alternative data sources may exist. These consist of surveys carried out, usually with foreign assistance, that do not form part of the national statistical system. Some of these

studies are of high quality in difficult conditions. These may be the only statistics available but are often unique exercises that do not form part of a time series. The user should check that these statistics adhere to international methodological standards that are adapted to local conditions. Coverage may be of only a part of the country and geographical disaggregations may or may not follow national administrative divisions. Comparability with national data may be difficult.

### V4.3.5. Improving sector statistics

The objective of any intervention on statistics is to improve their availability and quality, which consists of relevance; accuracy and reliability; timeliness and punctuality; coherence and comparability; and accessibility and clarity. In this way, quality statistics meet the information needs of their users. Interventions should address any critical points in the data chain, from conception of the statistics, system setup via data collection and processing through to the publication of statistics.

Statistics on agriculture, forestry and fisheries have a wider range of users than most sector statistics, whose needs cover social, environmental, income and business issues; users are both national and international. NGOs concerned with poverty and the environment and international commodity traders use the same statistics. Sector intervention should support national government policies that take account of these disparate needs, perhaps through a national strategy for development of statistics or similar exercise.

Links to key initiatives and strategy papers can be found in the 'To find out more ...' box at the end of this chapter.

#### **Box V4.3.2: Some specialist FAO datasets**

##### **GLIPHA**

The Global Livestock Production and Health Atlas (GLiPHA), is a user-friendly, highly interactive electronic atlas using the Key Indicator Display System (KIDS) developed by FAO. The atlas provides a scalable overview of spatial and temporal variation of quantitative information related to animal production and health through the combination of maps, tables and charts.

##### **Forestry Country Information**

The Forestry Country Information contains statistics on forest and forestry issues on a country-by-country basis including forest cover, plantations, volume and biomass as well as fires.

##### **AQUASTAT**

AQUASTAT is FAO's global information system of water and agriculture developed by the Land and Water Development Division of FAO. AQUASTAT provides users with comprehensive statistics on the state of agricultural water management across the world, with emphasis on developing countries and countries in transition.

##### **Gridded Livestock of the World**

This FAO dataset provides geographical information and resources relating to global livestock systems covering: 'all aspects of the supply and use of livestock commodities, including the distribution and abundance of livestock, the different production systems in which they are raised, estimates of consumption and production now and in the future, the people engaged in livestock production and the benefits and impacts of keeping livestock.' It aims to provide 'Detailed, contemporary data sets on the global distribution of the most important species of farmed animals [which] have a wide range of applications in understanding the social, economic, environmental, epidemiological and public health impacts of the livestock sector.'

##### **Domestic Animal Diversity Information System**

The database supports analysis of the diversity of livestock breeds on national, regional and global levels including the status of breeds regarding their risk of extinction. According to the website, it enables the user 'to make informed decisions on the management of animal genetic resources.'

The 'Global Strategy to Improve Agricultural and Rural Statistics' provides a framework for project conception and design that responds to the range of user needs while complying with international methodologies and ensuring sustainability. The Global Strategy website provides a vast store of relevant information, including notably the 'Guidelines on Strategic Plans for Agricultural and Rural Statistics (SPARS)'.

A regional approach may be useful if countries have similar needs or a common capacity building mechanism exists. The 'Pacific Strategic Plan for Agricultural and Fisheries Statistics' is an example of a regional approach.

A useful tool is to organise design working groups or workshops with key users and data providers. These meetings can be used to define an action plan and prepare recommendations on methodologies. The user group should not only comprise international organisations and national authorities but also NGOs involved in these fields as well as independent researchers and analysts.

Data on agriculture, forestry and fishing are often collected both by the NSIs and by ministries of agriculture, rural development, environment, etc., and associated administrations. Estimates of e.g. crop production and area may be published both by the NSI and the responsible line ministry, often with different results. An efficient use of resources requires that data collections are not duplicated. It is therefore vital to establish close cooperation between the institutions concerned. There is no general recommendation on which agency should compile specific statistics; this depends on the structure of the national statistical system. A formal service-level agreement or memorandum of understanding, especially for statistical activities not covered by legislation, is often necessary to align the interests of the two services. The existence of competing data sources is an opportunity to improve the data by consolidating the various exercises and make better use of resources. Resolution may depend on effective coordination of the national statistical system.

International statistical methodologies specify acceptable data collection methods and validation procedures. Introduction of new data collection, processing and validation techniques may be required to meet the quality requirements. Remote sensing by satellite; implementing a GIS framework; employing telephone- or computer-based interview and data capture; and web-based data processing and dissemination are all regularly used in developing countries.

A key quality issue is that basic credibility and consistency checks on the data are implemented. These checks are especially important to agriculture, forestry and fisheries statistics, which normally draw on several different sources. In particular, methods and coverage should be compatible between the organisations that collect these different data.

In developing countries, the handling of agriculture, forestry and fishing in the informal sector is also of huge importance for the completeness and information value of the statistics.

Introduction of food balance sheets, discussed in section 17.2 above, may be used to improve data coherence. These enable, for example, production data for a specific crop can be validated against data from markets, cooperatives and wholesale buyers in order to assess differences in data between the two sides of the crop market.

The Global Donor Platform for Rural Development (GDPRD) sourcebook of indicators for monitoring and evaluation: 'Tracking results in agriculture and rural development in less-than-ideal conditions' provides the means for setting up an indicator based monitoring and evaluation system.

The OECD handbook 'Measuring the non-observed economy' presents different approaches for measuring and estimating the scope and value produced by the 'informal economy', i.e. also covering subsistence activities. Approaches are presented both within the frame of national accounts and for statistics on normally non-observed structures, production and employment.

### **Box V4.3.3: Using new technology to improve data quality: LSMS-ISA**

The Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA) seeks to improve agricultural data in Sub-Saharan Africa. At the heart of this project is engagement with both line ministries and national statistical offices to design and implement panel household surveys emphasizing agriculture.

Besides supporting the production of high quality household level data, the project emphasizes the validation of measures and indicators and promotes research in data collection methods. Some of the areas being considered include improved methods for quantification of agricultural production, particularly for difficult-to-measure crops such as tubers and vegetables; measurement of agriculture and non-farm self-employment income; and for understanding how farmers are adapting to and mitigating the effects of climate change.

The new surveys employ state-of-the art techniques and methods, including GIS technologies and the use of Computer Assisted Personal Interviews (CAPI) to provide more accurate estimates and reduce the time lag between data collection and dissemination

**To find out more...****Core strategies**

- [Global Strategy to Improve Agricultural and Rural Statistics](#) (UN Statistical Commission, World Bank, FAO, Eurostat, US Department of Agriculture, International Statistical Institute) (2009)
- [Global Strategy resource centre](#)
- [Food and Agriculture Organization \(FAO\): World Programme for the Census of Agriculture 2020](#)
- [International Conference on Agricultural Statistics \(ICAS\): Modernization of Agricultural Statistics in Support of the Sustainable Development Agenda](#)
- [World Bank: Living Standards Measurement Study – Integrated Surveys on Agriculture \(LSMS-ISA\)](#)
- [Factsheets on the 21 SDG indicators under FAO custodianship. A highlight of the main indicators with the greatest gaps in country reporting](#)

**Further strategies and methodologies**

- [The Wye Group Handbook on Statistics on rural development and agricultural household income](#) (UNECE, Eurostat, FAO, OECD, World Bank)
- [FAO sourcebook Tracking results in agriculture and rural development in less-than-ideal conditions](#)
- [FAO resources on food balance sheets](#)
- [FAO Guidelines for the compilation of Food Balance Sheets](#)
- [EU Economic Accounts for Agriculture; Regulation \(EC\) No 138/2004 on the economic accounts for agriculture; Regulation \(EC\) No 212/2008 amending Annex I to Regulation \(EC\) No 138/2004](#)
- [EU IRENA - Indicator Reporting on the Integration of Environmental Concerns into Agriculture Policy](#)
- [FAO - A Literature Review and Key Agri/Environmental Indicators, 2017](#)
- [UN System of Environmental-Economic Accounting](#)
- [UNECE - System of Environmental-Economic Accounting](#)
- [FAO Guidelines on data collection for national statistics on forest products](#)
- [EU Integrated environmental and economic accounts for forests](#)
- [Coordinating Working Party on Atlantic Fishery Statistics \(CWP\) Handbook of Fishery Statistical Standards](#)
- [FAO - Strategy for Improving Information on Status and Trends of Capture Fisheries](#)
- [World Fish Center / World Bank LSMS-ISA: Sourcebook on the 'Design and Implementation of Fishery Modules in Integrated Household Surveys in Developing Countries' \(2012\)](#)
- [Eurostat Aquaculture Handbook, 2018 edition](#)
- [Eurostat Catches and Landings Handbook, 2019 edition](#)
- [Evaluation of the European Fishery Statistics, 2019](#)
- [Pacific Strategic Plan for Agricultural and Fisheries Statistics](#)
- [Tracking results in agriculture and rural development in less-than-ideal conditions](#)
- [OECD Measuring the Non-Observed Economy - A Handbook](#)

**Data sources**

- [Eurostat free statistics database Eurobase](#)
- [Eurostat Metadata and RAMON metadata server](#)
- [Eurostat statistics on agriculture](#)
- [EU Commodity price dashboard](#)
- [DG AGRI-JRC - Production, trade and apparent use](#)
- [DG AGRI-JRC: EU Food Balance sheet; Balance sheets by sector](#)
- [Eurostat agri-environmental indicators context](#)
- [EU agri-environmental indicator set](#)
- [Eurostat Fisheries Statistics](#)
- [European Market Observatory for Fisheries and Aquaculture Products](#)
- [Food and Agriculture Organisation \(FAO\) statistics](#)
- [FAO - FAOSTAT](#)
- [FAO - CountrySTAT](#)
- [FAO - Global Livestock Production and Health Atlas \(GLiPHA\)](#)
- [FAO - Gridded Livestock of the World](#)
- [FAO - Domestic Animal Diversity Information System](#)
- [FAO - Forestry Country Information](#)
- [FAO - AQUASTAT](#)
- [FAO Global Livestock Environmental Assessment Model \(GLEAM\)](#)
- [FAO Global Forest Resources Assessment](#)
- [FAO Fishery Statistics](#)
- [FAO Yearbook of Fishery and Aquaculture Statistics](#)
- [FAO / EU Agriculture Stress Index System 2](#)
- [Agricultural market information system](#)
- [Indian Ocean Tuna Commission](#)
- [UNECE - Statistics](#)
- [OECD Agriculture and fisheries web site](#)
- [International Tropical Timber Organization \(ITTO\)](#)

**European Union - further documents**

- [Regulation No 1165/2008 – animal statistics](#)
- [Regulation No 2015/1557 – crop statistics](#)
- [Eurostat Annual Crop Statistics – Handbook 2020 Edition](#)
- [Eurostat Farm Structure Survey – Statistics Explained](#)
- [EU Agricultural Price Statistics; Handbook for EU Agricultural Price Statistics](#)
- [DG Agriculture and Rural Development \(AGRI\)](#)
- [DG Environment \(ENV\)](#)
- [European Environment Agency \(EEA\)](#)

## **GETTING IN TOUCH WITH THE EU**

### **In person**

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)

### **On the phone or by email**

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

- by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
- at the following standard number: +32 22999696 or
- by email via: [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)

## **FINDING INFORMATION ABOUT THE EU**

### **Online**

Information about the European Union in all the official languages of the EU is available on the Europa website at: [https://europa.eu/european-union/index\\_en](https://europa.eu/european-union/index_en)

### **EU Publications**

You can download or order free and priced EU publications at: <https://op.europa.eu/en/publications>. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see [https://europa.eu/european-union/contact\\_en](https://europa.eu/european-union/contact_en)).

### **EU law and related documents**

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: <http://eur-lex.europa.eu>

### **Open data from the EU**

The EU Open Data Portal (<http://data.europa.eu/euodp/en>) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.

# Guide to statistics in European Commission development cooperation 2021 edition

## VOLUME 4: ENVIRONMENT AND CLIMATE CHANGE

The “Guide to statistics in European Commission development cooperation” provides extensive information on statistics in development cooperation, presenting key international initiatives supporting developing countries in building sustainable statistical systems that produce quality statistics. This new edition of the Guide is updated with information on key developments, including the Sustainable Development Goals and the SDG indicators framework, the UN World Data Forum and other significant initiatives.

The Guide explains the ‘statistical machinery’, covering the organisation, functioning and products of national statistical systems, as well as key international quality frameworks and principles. It presents tools for assessing statistical systems, strategic plans for developing statistical institutions, management of national projects/programmes in the field of statistics, training, as well as different aspects of statistical capacity building.

It presents a summary of EU support to statistics, including issues such as requests for support to statistical capacity building, indicators to feed result-based management tools, monitoring development partnerships or assessing the performance of policies and interventions.

The Guide can be used to identify and develop actions to support statistics and statistical indicators to define and follow-up cooperation programmes, including sector policies. It provides insight into the statistics in a wide range of specific sectors, from agriculture to social statistics, from sustainable development indicators to business statistics. This new edition of the Guide groups the previous sector chapters into four new thematic volumes on: the Sustainable Development Goals and indicators; Social statistics; Economic statistics (will be updated at a later stage); Environment and climate change.

Finally, it should be noted that this is the fifth edition of the Guide, the previous editions being done in 2011, 2012, 2013 and 2017.

---

**For more information**

<https://ec.europa.eu/eurostat/>